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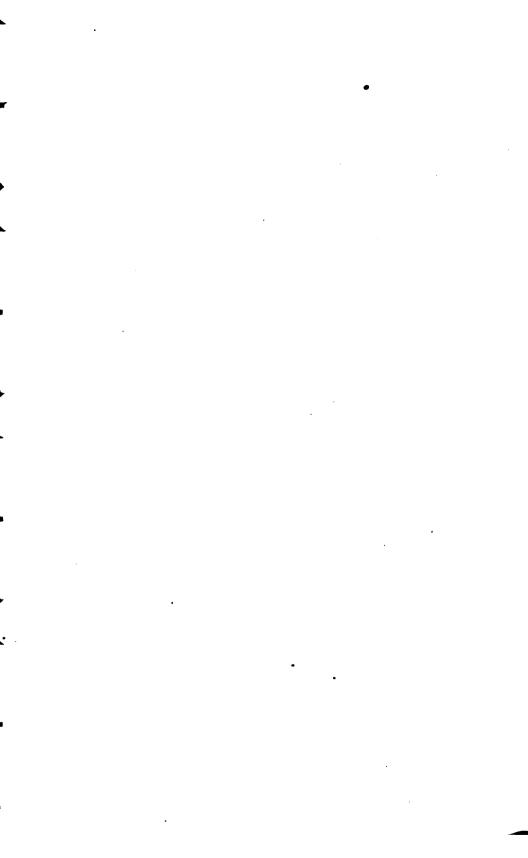
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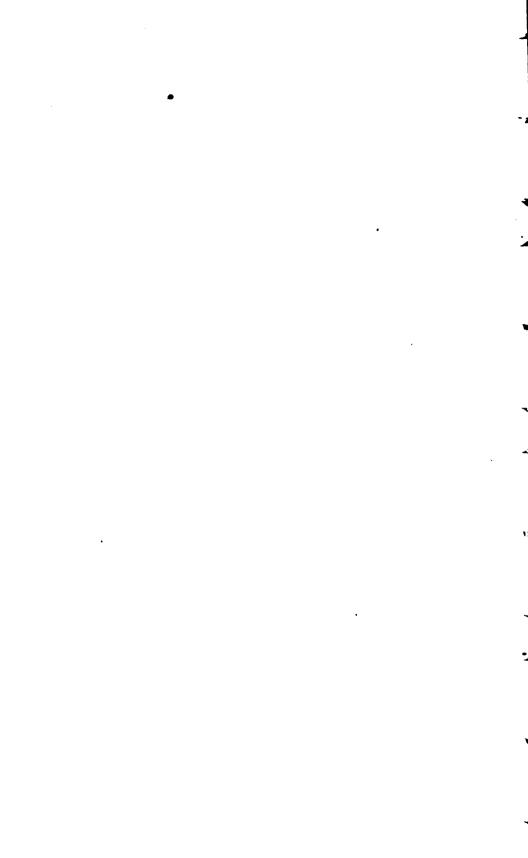
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Leland Stanford Junior Briversity











REPORT

OF THE

SECRETARY OF WAR;

BRING PART OF

THE MESSAGE AND DOCUMENTS

COMMUNICATED TO THE

TWO HOUSES OF CONGRESS

AT THE

BEGINNING OF THE SECOND SESSION OF THE FORTY-NINTH CONGRESS.

IN FOUR VOLUMES.

VOLUME IV.

WASHINGTON: GOVERNMENT PRINTING OFFICE. 1886.

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LETTER OF TRANSMITTAL.

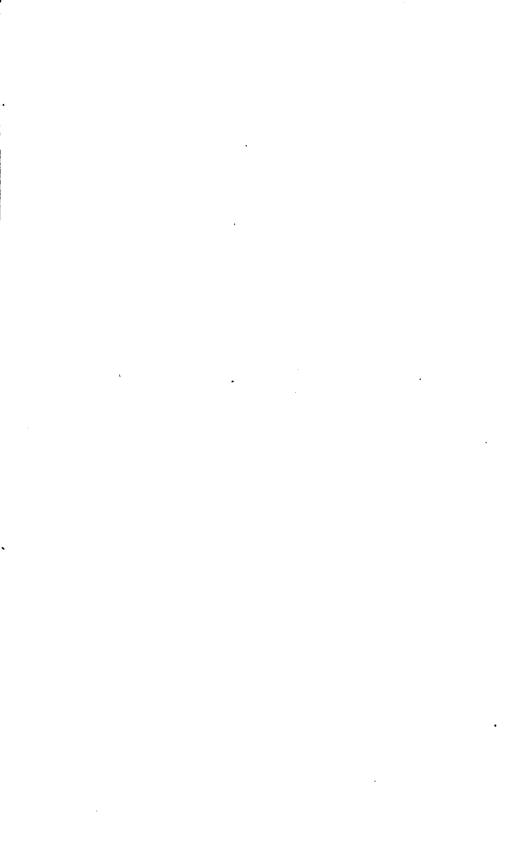
SIGNAL OFFICE, WAR DEPARTMENT, Washington City, October 26, 1886.

SIR: I have the honor to forward, herewith, the Annual Report of the Chief Signal Officer of the Army, for the year ending June 30, 1886. This annual report is largely reduced, being only one-fourth the size of the report for last year; three-sevenths of the report for 1884; one-third of the report for 1883; and less than one-fourth of the reports for the years 1882, 1881, and 1880. The tables in the reports for 1884 and 1885 contained 400 pages, while the tables in this report will not occupy more than 130 pages. Only tables of current value and of a special interest have been selected from the large number prepared.

I am, very respectfully, your obedient servant,

W. B. HAZEN,

Brig. and Bvt. Maj. Gen., Chief Signal Officer, U. S. A. The SECRETARY OF WAR.



REPORT

OF THE

CHIEF SIGNAL OFFICER.

SIGNAL OFFICE, WAR DEPARTMENT, Washington Oity, October 9, 1886.

SIR: I have the honor to submit, herewith, my report upon the work of the Signal Service during the fiscal year ending June 30, 1886, and to refer to the action based upon the report of the Joint Commission of Congress on the Signal Service, appointed with a view to secure greater efficiency and economy in the administration of the public service.

INSTRUCTION.

The course of instruction at Fort Myer, as announced in my last annual report, has been continued during the year, providing for the theoretical and practical instruction of the officers and enlisted men in the duties required of the Signal Corps in time of war and for the

meteorological service.

The whole theory of the organization is that the entire force of the Signal Corps shall be available for immediate service in case of war. With this end in view, Fort Myer has been utilized as a post of instruction where the officers and enlisted men are made expert in flag and torch signaling, in the use of the heliograph, telegraphy, and in the service of the field telegraph train. The work of a signal corps now forms an essential feature of all field operations in the time of war, and the history of this corps affords numerous instances where the information furnished the commanding generals during the late war determined the success of the campaign. It is no longer a question that the best signal corps should form a part of every well-organized army. Foreign powers have recognized the importance of this subject, and during peace these corps are employed in making careful experiments, with a view of improving the methods of communicating by visual signals, and in the mode of operating field telegraph trains.

One of the chief advantages of maintaining Fort Myer as a school of instruction has been that men were being constantly instructed in military signaling, and although these men may not remain in the public service they are fully qualified to enter the military service as officers

in case of war.

The Division of Military Signaling, which was established last year under the charge of an officer, has been continued, and many improve-

ments have resulted from the special attention given to this subject. A new field telegraph train has been partially constructed, the wagons of which are smaller and lighter than those now used by the Signal Corps, and are therefore better adapted to the rough roads of this country. The heliograph has been improved after careful experiments. A new signal kit has been devised and is now undergoing practical tests; it is believed that the improvement in the torch of this kit will prove specially serviceable. A new signal code has been prepared and adopted for universal use in the Army and Navy. A new manual of signals has also been prepared and will be ready for publication as soon as the reports relative to the tests now being made of the new signal apparatus have been examined.

Thirty carefully selected men were enlisted by the officer in charge of this division, and stationed at Fort Myer. A thorough course of instruction was commenced for the purpose of supplying a number of men expert in all kinds of signaling, and having them ready at a moment's notice for field work. At the opening of the Indian campaign in Arizona I received urgent telegraphic requests from General Miles for men expert in the use of the heliograph, and I was enabled to promptly send three small detachments into the field to aid in this important campaign, and I am informed that these men rendered valuable service, and invite attention to the following extract from the annual report of Gen. Nelson

A. Miles, commanding that department:

Early in April I decided to make prominent use of the Signal Service, and so notified the Chief Signal Officer of that Bureau, and in answer to my request he furnished me ample men and appliances for making that service most useful and effective. The reports of Lieutenants Drave and Fuller show the working of the most interesting and valuable heliograph system that has ever been established. I have made this service useful heretofore, and it would be found valuable in any Indian or foreign war. These officers and the intelligent men under them have made good use of the modern scientific appliances, and are entitled to much credit for their important service.

Referring to the surrender of the chief, Natchez, General Miles reports:

They found troops in every valley, and when they saw heliographic communications flashing across every mountain range Geronimo and others (who had already surrendered) sent word to Natchez that he had better come in at once and surrender.

The organizations of signal corps of foreign armies have been studied and several translations bearing upon military signaling made for the purpose of improving our own service. Example to report of the officer who has had charge of the Division of Military Signaling will be found

in an appendix.

I am convinced that thorough instruction cannot be given at any post in the Army where signaling is not the chief feature of instruction. Signal apparatus and a field train fully equipped and horsed ready for active service should be maintained for practice and experiment, and I earnestly recommend that the full force of the Signal Corps authorized by law be maintained, and that of this force a company of at least three officers and fifty men be stationed at Fort Myer, or at some other military post, and provided with a section of fully equipped field-telegraph train, for instruction and experiment.

Through the action of the Joint Commission of Congress the school of instruction in meteorological duties and military signaling at Fort Myer is closed, and the Signal Service has ceased to exercise control over that post. I am of the opinion that this was done under a misconception of the facts; and I am confident that it is in conflict with the best interests of the Government. By the terms of the resolution

the Commission was to recommend as to "economy and efficiency," and it is presumed that action was taken upon what was supposed would effect these ends. It was said on the floor of the Senate that Fort Myer was "rather an expensive place," when in fact it was the most inexpensive feature of the Signal Service, and a source of actual saving of many thousand dollars annually to the United States.

The maintenance of that post, under the broad sense of cost, will be presumably the same in either case. The fifty men (which is less than the average that has been kept there the past twelve years, a small per cent. at the depot of instruction at any military establishment) cost no more than common soldiers anywhere, or \$15,000 a year, at \$300 each. But now these men at once receive commutation for fuel, food, and quarters, indispensable allowances when soldiers are not at a military post, amounting on an average to \$812 a year each, or \$40,600 before they have learned their duties or can return any service to offset this cost. Besides, by entering in classes semi-annually, as formerly, the average strength of the Corps was 485, saving \$12,180, making a total in these two items alone of \$37,780. There were other items of several thousand dollars a year saved by the old plan, which cannot be done now.

To offset this, the Commission reduced the Corps thirty men, equaling in money \$24,360. Thus, while depriving the service of thirty men, it really added \$18,360 to the cost of the service; which fact I endeav-

ored to explain to the Commission.

Fort Myer was a place of probation, where, without expense, men who were unfit for the service, as many who offer themselves are, were weeded out and discharged. Now this cannot be done until much money has been spent upon them, and the service impaired by bad work and conduct. Nor is it understood how men entering upon this vocation without preparation are as efficient as when that preparation is complete, as was the case here. The present plan must inevitably bring into the service many men not fit for it, and this fact cannot be learned until much time and money are lost and the service impaired. I had supposed these considerations would control the action of the Commission, but it could not have fully understood the subject.

I found Fort Myer in a wretched condition of dilapidation and decay, and with the five years of attentive work which I had given it (without calling upon the Government for money, mainly by a systematic use of freedmen's labor for rents) it was fast becoming a beautiful and valuable suburb of the capital. I therefore exceedingly regret that this work must now largely go to waste on account of the great difficulty in keeping it in order, because of its uneven site, easily washed by rains, and the want of facilities in a line command, unless, as I hope, Congress, which I believe acted from a misconception of the facts, will recede from its action before the harm to the post and the Signal Service is beyond remedy.

The action of this Commission tends to stop instruction in military signaling also; and it was said upon the floor of the Senate that this action was based upon the testimony of the Lieutenant-General, that the Army was doing this sufficiently well without the Signal Corps, and it was said in debate that the unanimous testimony supported this view. This was either erroneously stated, or the testimony was not

exhaustive.

I believe this action was taken also upon a misconception, and it is opposed to the military spirit of the times. My opinion is based upon the fact that the practice of signaling in the Army had run into

neglect, until required to be resumed by a recent order asked for by the Chief Signal Officer, and upon the fact that General Miles and other commanders in the field earnestly called for and received detachments of Signal Service men for signal duty because the line of the Army could not furnish them, and also because good military service requires specialized duties, and that all other good armies specialize this work. The use of the telegraph, the heliograph, and other complicated instruments, and the running of telegraph lines, require too great experience to be acquired by any but those specially trained for it. The value of a staff officer well versed in the use of these instruments, who can at any time cut in upon the line of telegraph, may be of incalculable value.

This reference was necessary, since the law, both presumably and by mandate, makes the Chief Signal Officer responsible for the efficiency of this branch of the military service, and it would seem that this action is not in harmony with that fact, but has largely deprived him of the facilities for doing what the law requires.

The instruction of officers charged with the preparation of weather predictions, the announcement of approaching frosts, and the ordering of storm signals now embraces a course of study under the most

distinguished professors of meteorology in this country.

The course of instruction in military surveying and field sketching was included with the above with a view of increasing the efficiency of the signal officers in field work in time of war. Seven second lieutenants of the Signal Corps have pursued the course during the year. There are officers of the line now serving as Acting Signal Officers, who have been connected with the service for years, who have done a greater portion of the work which makes the service a necessity, and who ought to be retained in the service.

The Joint Commission of Congress said of them in its report:

The Commission also believe that the Army officers " " have also been of very great service in the past, and that their knowledge and experience should be utilized in the future, as to them is largely due the credit of building up the service to its present degree of usefulness.

Congress, recognizing the importance of retaining these officers of long experience permanently with the corps, enacted as follows:

And the Secretary of War is authorized in his discretion to detail for the service in the Signal Corps not to exceed five commissioned officers of the Army.

It is important to the service that these officers should feel the degree

of permanency indicated by the Commission.

The study of popular meteorology has been greatly stimulated by the work of the Signal Service and the popular interest in this subject which is increasing, owing to the wider distribution of the daily weather forecasts of this service, has induced many colleges and schools to add a course in meteorology as a part of the regular course of instruction. To meet the demands for a text-book, I directed Prof. William Ferrel, Assistant, to prepare a work which would serve as a text-book for advanced students of meteorology. This treatise has been printed and will soon be ready for issue. It contains the most appropriate and important of the various papers of original research on meteorology.

The object of this work has been to select from the material on hand some of the more important principles, methods, and results arrived at mostly during the last quarter of a century, and to present them in the form of a text book for use in the meteorological work of the Signal

Service.

A knowledge not only of correct principles and the best methods, but also of what has already been done, is of great importance to any one who would engage in any line of meteorological work, and especially of original research. Many very important laws have recently been deduced theoretically and confirmed by observations and experiment. Solar and terrestrial radiation, the conditions determining temperature, the relations between the amount of solar heat received by different parts of the earth's surface and the corresponding resulting temperature, the effect of the deflecting forces of the earth's rotation on the mechanics of the atmosphere, and the theory of the general motion of the atmosphere, and of cyclones, tornadoes, &c., are subjects which have recently received much attention.

The Signal Service has been specially fortunate in securing the service of one so thoroughly qualified to prepare this valuable work, and its publication will materially aid the work of this service. An extended series of observations has been taken at various altitudes with a view of revising and correcting the hygrometric tables. These observations have been examined and new tables computed for the use of this service. Professor Ferrel's report on this subject is given in an appendix.

A new system of tables for the reduction of the barometer to sea level has also been prepared by Professor Ferrel, whose able discussion of

this important subject forms a part of this report.

The work of preparing a treatise upon the whole subject of meteorology and on the theory of instruments used in meteorology, by Prof. Cleveland Abbe, Assistant, is in fair progress, and it is hoped that it will be ready for publication within the year. When this work is completed it will serve as a popular text-book for students of meteorology.

Several translations, giving the most recent and reliable results bearing upon the science of meteorology, have been completed, and some means should be provided which would enable this service to republish

the more important of these.

The plan of securing as observers young men qualified by education for the pursuit of scientific studies, and thus raising the standard of the enlisted force of the Signal Corps, has now been in operation five years, and of the three hundred and seventy-eight enlistments made during that time, ninety-seven were college graduates; and it has proved of benefit to the service.

INDICATIONS.

The weather forecasts and cold-wave and storm warnings have been regularly issued during the year, and the increasing demand for these forecasts may be taken as evidence of their value. The office is unable to comply with the numerous requests received from cities, towns, and corporations for the special warnings, owing to the limited appropriation for this branch of the service. The manner of making these predictions has been improved by substituting the names of States in place of the names of arbitrary districts previously used by this service. This plan removes all doubt as to the territory to which the prediction applies.

The forecasts prepared at 1 a.m. are telegraphed by special message to the principal centers of population, to the directors of State weather services, and to various lines of railroads, for the information of the public. Signals have been devised for the purpose of extending the information thus conveyed, and a large percentage of the population

are enabled to obtain the indications through these visual signals. When practicable, at midnight the Indications Officer is required to make special weather forecasts for selected States applicable to the suc-

ceeding forty-eight hours.

In addition to the regular indications, which are issued tri-daily, a special bulletin is issued whenever the conditions indicate changes in any section of the country which should receive especial mention. This bulletin contains warnings of approaching frosts, cold waves, dangerous floods, and the movement of well-defined storms, and the officer who prepares this bulletin is directed to telegraph to all Signal Service stations in the threatened regions, and the observers receiving such dispatches are directed to give still wider distribution by using every means by which they may reach the general public. Special bulletins are also issued on the first of each month, containing a general statement as to the mean temperature and total precipitation of the month just closed. together with brief descriptions of damaging frosts, severe storms, &c., which may have occurred. The information thus promptly furnished is utilized by those interested in agriculture and the grain trade, and it contains official information as to the weather conditions which have existed during the month in all sections of the country.

Indications have been issued from San Francisco during the year for the States on the Pacific coast with a view of giving the people living on that coast the full benefits of the service. This is of great value to many special interests. Cautionary signals have been established, special monthly bulletins issued, and meteorological data of interest to the people of the Pacific coast have been collected and disseminated.

The instructions governing the work in the Indications Division have been revised, and new and more rigid rules for determining the percentage of accuracy of the indications have been adopted, and the use of ambiguous language in the indications prohibited. A copy of these

instructions and rules will be found in an appendix.

The weather indications and storm warnings of this service would become more valuable if regular stations were established in the West Indies, and the number of stations increased in the West and in British America. Reports received from the sea-coast telegraph lines, in some cases, are of special value in the issue of storm warnings and securing aid for stranded vessels. Valuable cargoes have been saved and sailors rescued by the prompt information communicated over this line by Signal Service observers, and it should not only be maintained but extended along the more dangerous portions of the coast.

The following tables show the percentage of accuracy of the indications during the year. Each forecast of the several meteorological elements is carefully compared by the Indications Board with the weather conditions actually reported during the time for which the weather fore-

casts were made:

Percentage of verifications of indications for each month of the year ending June 30, 1886.

Year and month.	Weather.	Wind.	Temperature	Barometer.	General average.
I885. July August September October November December	79, 84 86, 61 84, 53	Per cent. 74. 59 70. 30 75. 52 77. 11 75. 77 77. 99	Per cent. 78, 86 80, 00 77, 22 76, 66 76, 93 76, 79	Per cent. 82.78 87.08 81.51 81.59 84.83 87.94	Per cent. 77. 44 76. 90 79. 95 79. 69 79. 08 80. 98
1886. January	86, 85 79, 04 83, 71	79. 45 80. 10 74. 22 80. 21 75. 99 67. 68	76. 55 82. 27 74. 91 75. 82 72. 80 73. 86	77. 34 82. 78 84. 67 76. 39 75. 53	79. 41 83. 04 76. 25 79. 87 76. 19 73. 07
Averages	82. 28	75. 74	76.89	92.04	78.48

The above table has been computed for the several elements and not for the geographical districts, as the forecasts were prepared for the individual States during the latter portion of the year.

The display of storm signals for the benefit of marine interests has been continued during the year, with excellent results. With a view of improving this feature of the Signal Service I directed a careful examination to be made of the system of storm signals of this service, and this investigation resulted in a new system of cautionary signals which went into operation May 1, 1886. A complete report giving the details of this new system of signals is inclosed.

The following table shows the number of storm signals ordered during the year ending June 30, 1886:

Cautionary signals displayed during the year ending June 30, 1886.

	Signals of all kinds.			
Year and month.	Number ordered.		Per cent. justified.	
1885.				
July August September October Morember December	75 120 177 152 276 232	38 76 139 134 198 . 207	50. 7 63. 8 72. 9 86. 2 71. 7 98. 2	
Isse. January February March April May June	199 162 152	155 179 137 84 24	81. 6 90. 6 84. 6 55. 8 46. 2	
Total	1, 846	1, 369	74.	

COLD-WAVE SIGNALS.

A full description of this signal and the principal features of the system of cold-wave warnings of this service were published in my last annual report.

The progress made in this important branch of meteorological work has been highly satisfactory, not only as regards the accuracy of predictions but also in the greatly increased facilities for disseminating the

warnings of the approach of cold waves.

The interest manifested by the general public, and the expense incurred by a large number of citizens in the purchase and proper display of cold-wave signal flags, sufficiently attest the value and importance of the system, and, judging from the reports made by observers during the year, I am convinced that property to the value of many millions of dollars has been saved through the agency of this service.

When it is expected that the temperature will fall suddenly fifteen to thirty degrees, or more, in any section of the country, the cold-wave warning is immediately telegraphed to selected stations of the Signal Service from twenty-four to forty-eight hours in advance, at which the cold-wave flags are immediately hoisted, in order that the public may be fully informed. The information is then sent by telephone and telegraph, whenever practicable, to all towns and railroad stations in the vicinity of the Signal Service stations displaying the signals.

Cold-wave signals are not ordered unless a temperature of forty-five degrees or less is expected. When the temperature is expected to fall twenty degrees, or more, in any district, and not reach forty-five degrees, announcement of cool wave approaching is made in the "Indica-

tions," but no signals are displayed.

Cold-wave warnings issued during January of this year were especially valuable in all sections of the country. Many individual reports have been received containing estimated value of the property saved through these warnings. I have received many applications for extension of this system for the protection of perishable goods and the sugar and fruit regions of the South. The cold-wave signal is now displayed, by orders from the central office, at two hundred and ninety cities and towns in the United States and from these points distributed by tele-

phone and railways to about twenty thousand stations.

The special report upon this subject, which will be found in Appendix No. 5, contains the detailed statement of the display of these signals at each station, with the resulting benefits. There is no feature of the service which has proven more valuable, and the system should be extended to every town in the United States, and also to stock agricultural districts where practicable. Many citizens have signified their willingness to purchase flags and display them at their own expense, provided the Signal Service would telegraph the warnings. I recommend that the sum of \$5,000, to be expended for the extension of this system, be added to the estimates for the fiscal year ending June 30, 1887, and in my judgment there is no appropriation which would be more acceptable to the people.

The following table shows the number of cold-wave signals displayed,

with the number and percentage justified.

Percentage of verification of cold-wave signals for months in the year, when they were necessary, ending June 30, 1886.

Year and month.	Number	Number	Per cent.
	displayed.	justified.	justified.
1885. October	93	72	77.4
November	150	126	84. 0
	149	139	93. 3
January February March	826	268	82. 2
	268	247	92. 1
	79	59	77. 2
Total	1, 065	911	85. 5

Of the 1,065 cold-wave signals displayed during the year, 911, or

85.5 per cent., were justified.

The work in this important division requires special study and experience to insure the best results, and the assistants who make the weather forecasts of this service should devote their whole time to the study of meteorology, and especially to the study of the tri-daily charts. This I expect soon to require.

STATIONS.

The number of stations in operation June 30, 1886, in the United States, was 452. These include the telegraph stations, display, special river, cotton region, sunset, and 12 repair stations. In addition, reports are received from 24 Canadian stations, by the co-operation of the Canadian Meterological Service. Telegraphic reports are received at this

office, daily, from 160 stations.

During the year four full reporting stations have been established and eleven discontinued. In addition to reports received from regular stations, 288 voluntary observers and Army surgeons at 65 military posts have furnished monthly reports which have been used in preparing the current publications of this office. The office has continued to co-operate with foreign observers in collecting simultaneous meteorological reports, and in this work reports have been received from 294

foreign stations and 616 naval and merchant marine vessels.

The reports received from stations have been carefully compared and tabulated for publication. The tables accompanying this report have been so arranged as to present a complete history of the meteorological conditions of the year. The weather, temperature, and rainfall for each month of the current year will be found useful in the study of climatology. In compliance with your instructions, I have had the tables of meteorological data usually published as part of the annual report of this Bureau carefully examined, and from this report I have excluded all data which is not specially useful to the public. Numerous tables previously published have been omitted and others condensed, so that this feature of the report will not require more than one-half the usual space given to meteorological data.

WEATHER SIGNALS.

The system of flags to indicate the probable conditions of weather and temperature recently adopted by this service has been universally commended by the public, and the region over which they are dis played has greatly increased during the year, and the office, for want of funds, has not been able to supply the demands. These flags are extensively displayed on lines of railroads and at railroad stations, and communicate by signal the weather forecasts of this service to many who are not within reach of the daily mail and to those who are

not supplied with the printed indications.

Being desirous of ascertaining the opinion of the general public as to the value of this service, I addressed a circular letter to those in charge of the display of these signals at various points, requesting that they report to what extent they give satisfaction. More than two hundred and fifty replies were received, commending in the highest terms this new feature of the Signal Service, which gives to many cities and towns the advantages of a signal-service station without expense to the Government. These are volunteer stations, and the flags are purchased by individuals, and a single telegram, costing not more than twenty-five cents, may serve to give the weather indications to many stations. For example, the State Weather Service of Alabama distributes the weather indications of this service to upwards of four hundred stations in that and adjoining States at an expense of not more than two dollars per day. This economical distribution of the warnings is due to the generous co-operation of the several lines of railroads within that region. These stations are also supplied with coldwave flags and receive the warnings from this office in like manner.

In addition to the system of flag-signals, a system of symbols is used by a number of railroad companies, these symbols being displayed on moving trains. The introduction of the signals and the rapid progress made during the year in establishing points of display indicate the rapid extension of the benefits of the Weather Bureau, and I am confident that its value to the country may be largely increased by further extension of the facilities for distributing the weather forecasts made by this office. The commercial and agricultural interests may receive greater benefits by increasing these stations. The service should be prepared to furnish flags and transmit daily telegrams to all important towns requesting the weather forecasts; and I recommend that \$10,000 be added to the estimates for the fiscal year ending June 30, 1888, for

this purpose.

FLOOD WARNINGS.

The work of watching, recording, and giving timely warning, by telegraph, of the rise and fall of rivers is an important feature of this service. During the past year I have reorganized and extended this system of reports; new river gauges have been supplied and the dauger lines more definitely determined. The daily reports of the condition of rivers, telegraphed to this office, are carefully examined by the indications officer, and these reports (considered in connection with the amount of rainfall occurring in any section) enable him to closely estimate the change likely to occur in the stage of water at neighboring river stations. The rate of movement of freshet waves in rivers upon which stations are located has been determined, and timely warnings of their approach are given to the threatened districts by the issue of special bulletins. A careful estimate shows that property valued at \$128,000 was saved at a single station (Nashville, Tennessee) by the flood warnings of the Signal Service on the Cumberland River during March and April of the current year. The expense to the Government in communicating the above warnings to all stations of that system,

including pay of river observers, was \$27.80. This single example

illustrates what is being done in the whole system.

These reports are not only valuable in times of flood, but they also serve a most valuable purpose in times of low water, enabling shippers to direct the movements of their vessels at the different points along the river course. These reports are serviceable to the agricultural and manufacturing interests in the river valleys. It is an economical service and should be extended. A detailed report, giving the organization of the river system and the value of the reports at the various stations, is inclosed.

RAILWAY-BULLETIN SERVICE.

This system continues in active operation, and its increasing popularity is made manifest through reports from railroad stations at which

the indications are posted for the benefit of the public.

This mode of disseminating the weather predictions is most highly appreciated by the agricultural interests in sections traversed by cooperating railroads; farmers consulting the bulletin at their local railway station, to be guided by its warnings before beginning the work of the day.

The indications are telegraphed over their lines by co-operating railroad companies each morning, without expense to the United States, and posted at 1,349 stations throughout the country. A few telegraph and telephone lines have within the past year taken up this system of distribution of the indications, and reports from their officials show that the success of the undertaking is much beyond their expectations.

A list of railroads and telegraph and telephone lines co-operating in

this work will be found in an appendix.

REPORTS FOR THE BENEFIT OF THE COTTON INTERESTS.

This system, which has now been in operation five years, has been continued under many disadvantages, owing to the small appropriation made for this work. It was inaugurated at the earnest solicitation of many prominent citizens of the South, especially the cotton-growers and those interested in the sale of this important staple, as an experiment. This service has never been able to establish the necessary number of stations over the wide area of country where this crop is grown to insure the best results, nor has there been sufficient money appropriated by Congress to pay for telegraphing the observations, and therefore the service still relies upon the generosity of various railroad and telegraph companies for the free transmission of the messages. This free service was only promised long enough to test it, a period long since expired.

The pay of the special observers employed is so small as to offer no inducement for prompt and reliable work. This service is of so much importance to those specially interested that a demand should be made for a sufficient appropriation for an increased pay of observers and for

prompt telegraph work.

The cotton crop is more or less at a risk during at least nine months of the year, and there is great need of prompt, accurate, and impartial information concerning the atmospheric influences and changes therein. Provision has been made for the maintenance of the 150 stations during the present season and the indispensable payment of the telegraph tolls by the Government. The stations have also been inspected by observers of this service experienced in taking observations. Each inspector

was directed to examine the location of instruments and to see that they were properly exposed. It has been my effort to make these reports valuable to those interested in the cotton crop, and if they are continued during successive years, and their results compared with the cotton production of corresponding years, the conditions particularly favorable or unfavorable may be determined some months in advance of the time at which planters are at present enabled to estimate the value of the crop.

TELEGRAPH DIVISION.

The regular tri-daily weather reports in cipher were received during the year over the wires of the Western Union, International Ocean, Florida, Gulf Coast, and Northwestern Telegraph Companies, and the promptness with which this large amount of telegraph work was performed enables me to report that the Signal Service has not once failed to issue its regular tri-daily forecasts. One million seven hundred and seventy-five cipher words were received and sent, and 80,590 telegrams for indications, cautionary signals, cold waves, frost warnings, &c., were sent and received from this office during the year.

UNITED STATES TELEGRAPH LINES.

At the opening of the year there were 2,582 miles of military telegraph lines under the control of the Chief Signal Officer, with 77 offices at or in connection with military posts on the frontier, and these lines were operated, with few exceptions, by the enlisted men of the Signal Corps. These lines were distributed among the several military departments, as follows:

	Beginning of year.	Ending of year.
Department of Dakota Department of the Missouri Department of the Columbia and California Department of Arizona Department of the Platte.	Miles. 893 582 512 510 85	Miles. 740 582 444 510 85
Total	2, 582	2, 861

Three hundred and three miles of telegraph line were abandoned during the year. Many of these lines are located on the frontier where Indian campaigns are likely to occur, and as they form the only communication with military posts they should be continued in repair.

The total receipts from tolls for commercial messages transmitted over the military telegraph lines during the year amounted to \$13,184.84; in addition \$22,324.31 were collected at military offices as tolls due commercial lines.

These telegraph lines are important factors in the protection of the widely extended frontier, especially in forming lines of communication for military posts over which information may be immediately sent in cases of Indian outbreaks. Wherever these telegraph lines extend meteorological stations have been established, and by this means sections of the country which were not traversed by commercial lines have been occupied by stations of observation.

The stations on these lines have formed a line of outposts for the weather service of the country, and the observations thus telegraphed have been of great value to the service. It is the policy of this office to abandon military lines as soon as the territory becomes accessible by commercial lines, the material of the abandoned line being either sold at auction or utilized in the construction of new lines at other points.

SEA-COAST TELEGRAPH LINES.

These lines extend along the Atlantic coast, in sections, from near Boston to Cape Fear River. Their purpose is to enable this service to secure meteorological reports from exposed points on the coast at which cautionary-signal stations might communicate warnings of dangerous storms to passing vessels. In the past it has served to communicate messages which secured prompt assistance to vessels in distress, and many lives and valuable cargoes were saved which, but for this line, would have been lost. It constitutes a coast guard, and should not only be continued but extended along the entire Atlantic coast. Such a completed line kept in good repair would not only add to the efficiency of this service but would also form a valuable adjunct to the Life-saving Service in the performance of its important work. The only additional sea-coast line constructed during the year was that connecting the island of Nantucket with the mainland, via Martha's Vineyard and sub-marine cable, 23 miles in length, and 38 miles of land line extending to various points on the island.

The importance of this system of lines and cables is evident from the amount of shipping on the water highway of Vineyard Sound, which bears annually from 35,000 to 42,000 sail and steam vessels engaged in the coast trade. The Signal Service stations at Wood's Holl, Cottage City, Edgartown, and Nantucket, with the display stations at Cedar Tree Neck, Sankaty Head light-house, and Gay Head light-house, when the latter is established, will furnish full and complete warnings of storms, high winds, and the general features of the weather to this great moneyed interest. The Signal Service is held in high esteem by these people, and they desire an extension of the benefits arising from the same. They regard with great satisfaction the connection of the light-house and life-saving station at Surf Tide, Nantucket, by telephone, with the telegraph offices. There is no question that this system is one of the most valuable operated by the Government, reaching, as it does, a highly cultivated, intelligent, and energetic class of people, and every effort will be made to place intelligent men at these stations and make it still more perfect and in every way worthy of the support that the people are willing to give it.

FROST WARNINGS.

The system of special frost warnings for the benefit of the tobacco, cranberry, sugar, raisin, and fruit-growing districts was continued in operation as organized in 1882.

The entire frost-warning system now embraces twenty-seven centers of distribution to which the warnings are sent from this office, and eight hundred and twenty-two frost stations where the warnings are bulletined and otherwise disseminated as soon as received from the centers. With the ready and efficient co-operation of the railroad and telegraph companies, a system of telegraphic circuits has been established for each center by means of which the warnings can be dis-

tributed with the least possible delay. The great drawback lies in the fact that rapid distribution is necessarily limited to points at or near telegraph stations, but it is expected that with the growing organization of State weather services a more general distribution of these warnings, by signals or courier, will be gradually provided.

The tobacco-growing districts to which warnings are sent are located in the western half of Massachusetts and the State of Connecticut, a portion of Southern New York, the eastern half of Pennsylvania, Central Maryland and Virginia, the western halves of North Carolina and Tennessee, the State of Kentucky, Southern Ohio and Indiana, Eastern Missouri, and the southern part of central Wisconsin.

Cranberry interests are protected in Central Wisconsin, in Barnstable County, Massachusetts, and along the Camden and Atlantic Railroad in New Jersey.

Frost warnings for the benefit of sugar-growers are distributed in Louisiana, from New Orleans as a center, and the fruit-growers of Florida receive warnings from Jacksonville and Sanford. Special messages are also sent from this office to points in North Carolina, South Carolina, Tennessee, and Texas.

Many commendatory reports have been received from planters and others interested, showing that this frost-warning service, even limited as it is, is of the highest value to the interests they are intended to protect. The expenses are trifling compared with the value of the information, being limited to the cost of telegrams at one-half the usual Government rates and to that of the blanks on which to bulletin the warnings.

STATE WEATHER SERVICES.

The plan of organizing State weather services, co-operating with the Signal Service, has met with encouragement during the year, and the evident value of such organizations in affording means for the rapid and economical distribution of the weather forecasts and frost and coldwave warnings of this service has led me to arrange for establishment of similar service in States where they are not now in operation. object of these local organizations is to increase, without expense to the General Government, the number of stations at which meteorological observations may be taken. The data thus collected by voluntary observers are utilized: First, by the chief of the State services issuing a bulletin, either weekly or monthly, containing an accurate and impartial description of the weather conditions which may have prevailed in the State during the time covered by the bulletin. Second, by the Signal Service at the central office in the preparation of the Monthly Weather Review, containing an account of the general weather conditions throughout the country during the month.

These local services also supply observations for special study of meteorology and climatology, and some of these services have issued interesting and instructive discussions on selected subjects containing general information which may be utilized in the work of this service. As an example of the economical distribution of the weather indications through these organizations, the distribution by the State weather service of Alabama, previously referred to under the head of indications, is cited. This single dispatch to the chief of the Alabama service is repeated by him to more than four hundred stations in that and the adjoining States at an expense not greater than \$2 per day. Independent of the interest these services have developed in the subject of meteorology, they are educating the people as to the value

of the weather reports, and enable a large class of the population not within reach of the daily papers to use the weather indications in the various industries. The great problem of this service is to discover the means which will enable it to communicate to threatened localities the information which is received at the central office of approaching weather changes, and no plan is more effective or economical in attaining this desired end than through the well-organized State services. With a view of improving this important feature of the service, I invited the several chiefs of State services to meet in this city to discuss various questions pertaining to the work being performed, in order that uniformity of action might be secured. A complete report, giving the operations of this branch of the service, by Lieut. H. C. Dunwoody, Acting Signal Officer and Assistant, who first suggested the organization of these services in connection with the Signal Service, will be found in an appendix.

SIGNAL-SERVICE AGENCIES.

Signal-service agencies for the benefit of commerce and the marine interests have been maintained during the year at New York City, Bosten, and Philadelphia. The agencies supply the captains of vessels with publications of this service in which they may be interested, such as descriptions of storms in the north Atlantic, the location of ice which may prove dangerous to navigation, and also provide standard instruments for comparing those used on board vessels. Four thousand and seventy-two ships' barometers were compared during the year with Signal Service standards, errors determined, and correction cards furnished. These vessels furnish in return simultaneous observations. which are used in the study of ocean meteorology. Weather reports have been received from five hundred and eighty-one vessels, of which seventy-three were furnished by the New York Herald weather bureau. Abstracts of logs of five hundred and fifty-seven vessels have been prepared and forwarded to the central office. In addition to these, the service is indebted to the New York Herald for one hundred and seventyone and the New York Maritime Register for five hundred and twentyone abstracts of logs. Arrangements have been made with the Meteorological Office of London, without expense to this service, for telegraphing to it the storm conditions reported by vessels arriving at ports of the United States. One hundred and twenty-five of such cablegrams were transmitted during the year. These dispatches contained specific data, obtained from incoming steamers, showing the location of icebergs, derelict ships observed, and position and bearing of storms encountered west of the fifty-fifth meridian.

The relations between the shipping interests and the Signal Service are satisfactory, and the Weather Bureau is generally commended by those interested in the commerce of the country.

SPECIAL WORK UNDER PROF. CLEVELAND ARBE.

Scientific correspondence.—This comprises questions bearing upon the work of this service and relating to hygrometry, hypsometry, evaporation, solar radiation, thunder-storms, tornadoes, sun-spots, and various other subjects pertaining to meteorology.

The sextant observations made by Lieutenant Lockwood during the sledging journey on the north coast of Greenland, in which he reached the "farthest north," were examined and found to be highly satisfactory.

The report thereon will appear as an appendix to Captain Greely's offi-

cial report of the expedition to Lady Franklin Bay.

Tables of monthly constants for the reduction of the barometer have been corrected for current changes. Much time has been given in this division to the discussion of the details of the new system of reducing the barometer to sea-level, and finally the whole subject was placed in the hands of Prof. William Ferrel, whose report on this subject is given in an appendix. Latitude, longitude, altitude, and magnetic variation stations have been furnished as required.

The question as to the proper exposure of thermometers in order to obtain the temperature of the air in the immediate neighborhood has been considered, and improvements adopted which promise more reliable results. Comparative observations have been made during the year with a view of improving instruments for determining errors in the movement of the velocity of the wind and for the purpose of determining the best location of rain-gauges. Meteorological observations have been taken at high altitudes during several balloon voyages, for the purpose of supplying data for the special study of the several meteorological elements. These observations are now being discussed.

The course of instruction for the second lieutenants of the Signal Corps included a series of lectures by Prof. Cleveland Abbe, Prof. T. C. Mendenhall, and Prof. William Ferrel, covering the general subjects of meteorology and natural philosophy. The class of officers were required to attend these lectures daily, and written examinations were held monthly from which the proficiency of the several members of the class in the subjects considered was determined and reported upon. A number of professional papers, Signal Service notes, and translations, which would prove valuable if published, have been prepared.

It would seem that restriction prohibiting the publication of such papers by a scientific bureau should be removed, as the results obtained by the careful study of these subjects should be given to the public, and these results would serve to improve the current daily work of this The work of collecting material for the subject index and author catalogue to the literature of meteorology has been continued. and this valuable work will probably be completed and ready for publication during the current year. The work of the present year has been chiefly the collection of new titles, the correction and completion of those already on hand, the formation of a subject classification, the actual classification of the titles by subjects, and the preparation of an author index.

A complete report of the work by Prof. Cleveland Abbe, Assistant, under my direction, will be found in an appendix.

INSTRUMENT DIVISION.

This division has the custody and care of all instruments, their comparison and adjustment with standards, and all questions relating to the use and construction of instruments are referred to this division for necessary action. About 5,000 instruments have been tested and issued in this division during the year. Improvements have been made in the instrument room both as to the method of keeping accounts and as to the character of the records. All thermometers and rain-gauges have been carefully tested, new forms have been introduced, and experimental studies of instruments have been made for the purpose of establishing a normal barometer, improvement in thermometers, psychrometers, and other instruments used in this service. The new rain-gauge

has been introduced to a considerable extent, over one hundred and fifty having been constructed during the year, many of which are now in use. Preparations have been made for the introduction of smaller wind-vanes than have generally been in use. The large 16foot wind-vane is unquestionably too sluggish in its action, and it is proposed to substitute one of a much smaller pattern. Much progress has been made in the study of atmospheric electricity during the year. For the purpose of investigating electrometers, collectors, and exposures, extended series of experiments have been conducted at this office. Six new electrometers, constructed after specifications prepared at this office, have been ordered for the prosecution of these Several new stations have been established throughout the country at educational institutions where special electrical observations are made. These observations are collected and the results published in the "Monthly Weather Review." Much interesting work has been done by means of simultaneous observations at this office and at the Smithsonian Institution. In connection with the subject of atmospheric electricity it may be mentioned that a series of experiments are under way for the purpose of determining the proper form and dimensions of lightning-rod "grounds." This is a matter of great importance and the results of the investigation will be of great practical value.

Experimental study in the methods of measuring ground temperature by means of electricity has been continued during the year, with very satisfactory results. I am indebted to Prof. E. S. Morse, of Salem, Mass., and Mayor John Gould, of Portland, Me., for a series of interesting and valuable observations of underground water-temperature. A detailed report of the work of this division, by Prof. T. C. Menden-

hall, Assistant, will be found in an appendix.

BOARDS OF TRADE.

The service continues its co-operation with boards of trade, chambers of commerce, and other commercial organizations in the large cities of the country, and relies upon these associations for advice as to the distribution of reports and the supply of weather indications which may be of interest in various sections of the country. Many of these organizations have appointed committees to confer with the Chief Signal Officer upon matters relating to the Signal Service as far as the work of the bureau will bear upon the commercial interests which they represent, and I am pleased to acknowledge the valuable assistance which these associations have rendered in aiding me to make the Signal Service more valuable to the country.

The board of trade at Saint Paul has taken charge of the State Weather Service of Minnesota, and under its excellent management there will be secured for the wheat-growing region of the Northwest what the system of cotton-belt observations has secured for the South, viz., prompt, accurate, and impartial information concerning the atmospheric changes, and daily reports of rainfall and temperature during

the growth of the crop.

Maritime associations of the country acknowledge the value of the storm warnings, and have asked for their extension. Reports show that valuable cargoes have been saved by vessels remaining in port in obedience to the warnings issued by this service. The shipping interests of the coast call for additional and more extended information during the cyclone season. It is important that this service should receive the first notice of the development of these storms in the West

Indies, in time to give telegraphic notice of their existence, in the various ports of the United States, several days before the storm reaches the coast. The bill now before Congress providing for the establishment of six stations in the West Indies expresses the demands of the shipping interests of the country and it should pass, as these stations will materially aid this service in giving notice of the approach of these destructive storms.

ARCTIC WORK.

The report of the scientific observations of the Lady Franklin Bay

Expedition is in course of preparation.

The actual observations, covering nearly three years' hourly record of pressure, temperature, clouds, rainfall, auroras, humidity, tides, and sea temperature, have been copied, and the sums and means calculated at Fort Conger have been checked and verified, and are substantially ready for publication.

The appendices, which were to be prepared by the U.S. Coast Survey, are in progress. The magnetic observations have been completed, reduced, and discussed by that office. The tidal observations and pendulum work are in the course of preparation, and the complete report

will be ready for the printer in a few weeks.

Apart from the receptions tendered by cities, corporations, and clubs in America and Europe, Lieutenant (now Captain) Greely has received the following distinctive honors and awards:

The thanks of the Commonwealth of Massachusetts.

Complimentary resolution of the Legislature of Dakota.

The thanks of the British Government for the return of union jack and admiralty dispatches.

The founder's medal of the Royal Geographical Society.

Complimentary resolutions from the Geographical Society of Paris. Complimentary resolutions from the American Geographical Society. Complimentary resolutions from the Geographical Society of the Pacific

Pacitic.

Election as honorary member of the British Association for the Advancement of Science; Scottish Geographical Society; Royal Swedish Anthropological and Geographical Society, as well as of other less well known associations.

Sergeant David L. Brainard has received from the Royal Geographi-

cal Society the Back Grant for 1886.

Some substantial reward should be given to the members of the International Polar Expedition, and it is hoped that Congress at its next session will recognize the successful work performed by Lieutenant Greely and his party by providing promotions of the survivors and support for the families of those who lost their lives while serving with this expedition.

APPROPRIATIONS.

The appropriations for this service have been expended under my close scrutiny and in accordance with the law authorizing it. This service has been maintained and good results secured, but it has been impossible to carry on the full work of the Bureau; while a slight increase in the appropriations would have enabled me to largely increase the benefits of the service to the people.

Additional cautionary-signal stations should be established on the lakes to meet the demands of those interested in lake navigation, and, to make this feature of the service complete, funds should be supplied, which would enable me to keep these stations open at night during the

storm seasons; this cannot be done now.

The cotton-region reports are becoming more valuable each year, and there is an increasing demand for the information thus furnished, but the limited appropriation for this branch of the service prevented me from commencing this system of reports at the usual date, April 1. These observations should be made continuous the full year, and the best results can only be secured by an increase of the pay of these observers. The estimates submitted for the coming year have been prepared with great care, and cover only the absolute needs of this service, which experience has demonstrated should be provided for, if the work of the Bureau is maintained on its present basis; but the service is growing, the demands upon it are increasing, and much more good work could be done in the distribution of weather forecasts, storm, frost, and flood warnings, if the appropriations for these branches of the service were increased.

The improved modes of administering the duties of the property and money division, inaugurated by me, have continued, together with some changes made during the year, in order to make the accounts more explicit and technically correct.

It is thought that the accounts now made up and rendered will be satisfactory to the accounting officers of the Treasury Department.

The advantages afforded to obtain greater accuracy by having instruments compared with our standards, for which no extra charge is made, still continues to induce many private persons, institutions of learning, &c., whose voluntary work is of great benefit to this service, to purchase instruments through this office; and during the year there have been two hundred and eighty instruments of various kinds purchased, representing a total cost of \$1,907.25.

These transactions have no connection with the public funds disbursed by the property and disbursing officer of this service. This

office simply acts as the agent of the manufacturer.

There have been 1,251 instruments of various kinds purchased during the year for the use of this service, and 1,859 instruments have been issued since the last report.

The condition of the appropriations (disbursed by this office) for the fiscal year ending June 30, 1886, with expenditures thereunder and balances, with probable demands on such balances, as required to be rendered by the act of Congress approved May 1, 1879, is as follows:

	Apppropriated.	Expended.	Balances.	Probable de- mands.
Observation and report of storms		\$96, 019 72 2, 511 32 20, 263 53	\$149, 980 28 2, 988 68 8, 736 47	\$126, 990 28 2, 988 68 8, 786 47

The amounts appropriated under the different heads for the support of the Signal Service, U. S. Army, for the fiscal year ending June 30, 1886, are as follows:

Legislative, executive, and judicial: Regular clerks, messengers, &c	\$10,660	00
Scientific experts, clerks, &c	40,000	00
Postage-stamps, postal union countries, allotted by the Secretary of		
War	1,069	00
Stationery, allotted by the Secretary of War	4, 108	00
Rent of buildings for Signal Office	7,500	00
Contingent expenses, allotted by the Secretary of War	7,417	49
Total	70,754	49

Sundry civil expenses: Observation and report of storms;		
Manufacture, purchase, and repair of instruments	\$10,000	00
Telegraphing reports	138,000	00
Expenses, storm signals	11,000	
Connection life-saving stations	7,000 1,500	
Instrument shelters	2,000	00
Rents, &c., of offices outside of Washington	41,500	
River and flood reports	10,000 25,000	
-		
Total	246,000	00
Maintenance and repair of military telegraph lines	24,000	00
		=
Pay, &c., of the Signal Corps:	99 850	ΔΔ.
Pay of officers	33, 750 200, 151	51
Mileage to officers	5,000	00
Commutation of quarters to officers	7,200	
Pay of contract surgeons	1,200	00
Total	247, 301	51
		=
Subsistence Department:	155 000	^^
Subsistence and commutation of rations, Signal Corps	155,000	00
Onortormostoria Department.		
Quartermaster's Department: Regular supplies—		
Fuel	6, 200	00
Commutation of fuel at \$9 per month	23,760	
Commutation of fuel at \$8 per month	23,040	
Forage for mules and horses	3, 100 1, 495	
Forage for officers' horses		
Stoves, and repairs to heating apparatus	400	
Lights	150	
Straw for officers' horses	109	
Straw for animals		
Straw for bedding	67	20
Total	58, 63 8	40
Incidental expenses—		_
Horse and mule shoes	500	00
Shoes and shoeing of officers' horses	234	
Blacksmith's and other tools		
Veterinary supplies	300	
Fire apparatus, disinfectants, &c	200 100	
· · · · · · · · · · · · · · · · · · ·		
Total		00 ==
Interment of officers and men	200	00
Apprehension of deserters	120	00
Transportation—		
Materials and funds	25,000	00
Officers and men	8,875	00
Means of, mules	1,000	
Means of, harness	130 500	
Means of, repairs to	500	-00
Total,	35, 505	00
		==

Sundry civil expenses—Continued. Quartermaster's Department—Continued. Barracks and quarters— Commutation of quarters Work and supplies for Fort Myer	\$84, 108 1, 500	00 00
Total	85,608	00
Clothing and camp and garrison equipage— Six wall-tents, &c	73 2,800	89 00
Total	2,873	89
Medical Department: Medical attendance and medicines, officers and men, Signal Corps Medical attendance and medicine, officers with Signal Corps. Medical and hospital supplies, Fort Myer Medicines from depots, &c Materials, repairs to hospital, Fort Myer	100 700 1,000	00 00 00
Total	7, 100	00
Ordnance, &c., Fort Myer	100	00
Printing and binding, allotted by the Secretary of War	14,000	00
Support of the Army: Expenses Signal Service, U. S. Army	5, 500	00
Grand total	954, 335	29

There is always an accumulation at this office of valuable Government property, and I would invite the attention of the Secretary of War to the very inadequate storehouse, and recommend that, if possible, some action may be taken to furnish storage-room of a better character and greater capacity.

It would seem that while several estimates have been submitted for a fire-proof building they have been thus far ignored, and the accumulated original records of the service, the result of the observations made, together with the valuable property, is worth protection. Congress should be urged to favorably consider the estimate submitted for a fire-

proof building adapted to the needs of this service.

The work of the Bureau in this city now necessarily occupies ten buildings, so located as to require a larger force of messengers and laborers than would be required were this work brought into a single convenient building. The rent now paid for these buildings is \$6,379.96 per year. A suitable building for the work of this service is located on the corner of 24th and M streets, northwest, with about 54,000 square feet of ground, owned by Mr. Ferguson, and may be purchased at the reasonable cost of \$108,000, and I recommend that an appropriation of this amount be made for the purchase of this building and grounds, and also that an appropriation of \$42,000 be made for the erection of the necessary storehouses on said ground for this service.

PROPERTY AND DISBURSEMENTS.

The improved methods of administering the duties of the Property and Disbursing Division of this office have continued, with gratifying results, and the accounts passed the scrutiny of the accounting officer of the Treasury with few suspensions, and these have been for a technical informality. All vouchers are paid by checks drawn to order and in no case to bearer; this mode being considered the safest, not

only in transmitting money, but it also furnishes the assurance that the money reaches the person for whom it is intended. All requisitions are carefully scrutinized before payment by a disinterested offi-The methods of verifying and settling accounts in this Bureau are those prescribed by the Army Regulations and are identical with those which govern in the Quartermaster's Department of the Army, with the additional check that these accounts pass the scrutiny of the Examining Division of this office before they are submitted to the accounting officer of the Treasury.

The service has been economically managed, and the additional care of the property, which is widely distributed over the country, has greatly increased the work of the division. Under the present rule each article purchased is taken up on a property report, which is rendered quarterly for transmission to the Third Auditor of the Treasury, so that there is not one article, from the merest trifle to the most expensive instrument that is purchased, but what is carefully reported to the accounting officer of the Treasury.

The experience of the past year furnishes additional reasons for renewing my recommendation for the erection of a fire-proof building for offices suitable for the use of the Signal Service, as per plans and estimates contained in Senate Ex. Doc. No. 152, Forty-eighth Congress, first session, unless the Ferguson property be bought. The buildings now occupied by this service are insecure, unsafe for the storage of

valuable property, and in every way unsuited to its use.

The annual report of Capt. Francis B. Jones, A. Q. M., U. S. A., property and disbursing officer of the Signal Service, will accompany

this report as an appendix.

PUBLICATIONS.

The "Monthly Weather Review" of the Signal Service has been regularly published during the year, and this publication is now recognized as one of the most valuable productions of the service. Each "Review" contains a general summary of the meteorological data collected at this office during the month; new features have been added, and improvements made during the year, which render this publication more complete. Charts are published with this "Review," showing the movement of storms over the United States and the North Atlantic Ocean, which are of special value to shipmasters.

The "Monthly Summary and Review of International Observations," based upon the data collected by mail without expense to this service, and containing the general weather conditions of the northern hemi-

sphere, has also been published.

Work has also been continued on the publication known as the "Meteorological Record," and by special authority of the Secretary of War the printing of this work for a single year has been continued and is near completion, bringing it up to November, 1878. This record is of special value in the study of storm-movements in the United States, and some provision should be made for completing the printing of the

The publications known as Professional Papers and Signal Service Notes previously issued by this service have been discontinued, in compliance with the law forbidding the publication of such papers as are not required for the current work of this service. In this connection I would say that the best results from this current work can only be attained by a careful study of the observations collected, upon which

such work is based, and therefore the discussions and generalizations by competent students have a direct bearing upon the current work of this service, and some provision should be made for the publication of such papers.

ORGANIZATION OF THE SIGNAL CORPS.

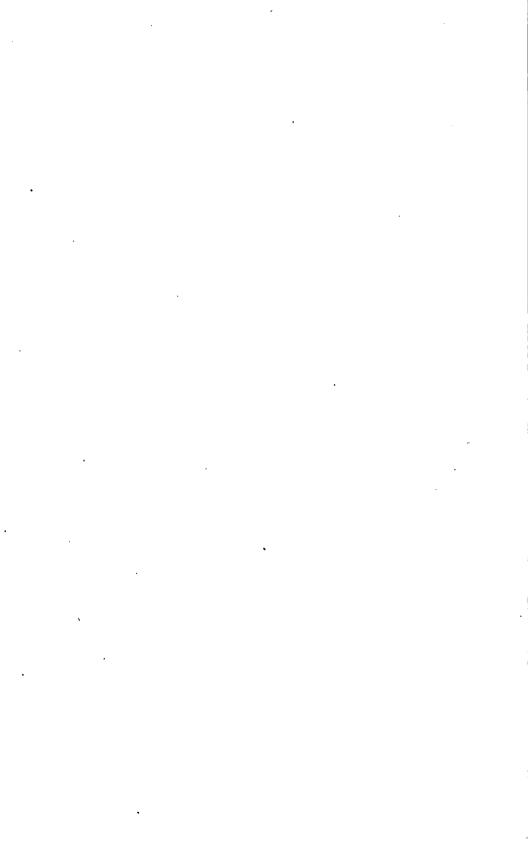
The necessity for grades of rank in every military organization has been recognized from time beyond record, and good men cannot be retained in the service which offers no reward for long and efficient work.

By retaining the experience of officers who have served for long periods in this service great economies can be secured each year and

serious mistakes avoided.

The recommendation of the Joint Commission of Congress investigating the Signal Service, relative to officers of long experience, should receive the approval of Congress, and some provision be made for the promotion of the officers of the Signal Corps, based upon length of service and ability to perform the duties which may be required of signal officers.

I am, very respectfully, your obedient servant,
W. B. HAZEN,
Brig. and Bvt. Maj. Gen., Chief Signal Officer, U. S. A.
Hon. WILLIAM C. Endicott,
Secretary of War.



LIST OF APPENDICES ACCOMPANYING THE BEPORT OF THE CHIEF SIG-NAL OFFICER OF THE ARMY FOR THE YEAR ENDING JUNE 30, 1886.

1.—Report of the officer in charge of the division of military signaling.

2.—Rules and regulations of the indications division.

3.—Report on State weather services.

4. - Report on cold-wave signals.

- 5.—Report upon weather signals.
- 6.—Report of the officer in charge of the Pacific coast division of the Signal Service.
- 7.—Report upon the system of cotton-region observations.
- 8.—Report on the display of signals for the protection of marine interests.
- 9.—River reports and flood warnings.
- 10.-Railway weather-bulletin service.
- 11.—Report of officer in charge of the correspondence and records division.
- 12.—Annual report of the officer in charge of the stations division.
- 13.—Annual report of the officer in charge of the telegraph division.
- 14.—Annual report of the property and disbursing officer.
- 15.—Annual report of the examining officer.
- 16.—Annual report of the officer in charge of the publications division.
- 17.—Annual report of the officer in charge of the meteorological record division.
- 18.—Report of tornado work.
- 19. Report of the assistant in charge of the study-room division.
- 20.—Report of officer in charge of the fact and international bulletin division.
- 21.—Annual report of Signal Service agencies.
- 22.—Annual report of the assistant in charge of the physical laboratory division.
- 23.—Report of Professor William Ferrel, assistant, on the reduction of barometric pressure to sea-level and standard gravity.
- 24.—Report of Professor William Ferrel, assistant, psychrometric tables for use in the Signal Service.
- 25.—Report of junior Professor H. A. Hazen, Signal Service, on thunder-storms.
- 26.—Instructions to voluntary observers of the Signal Service.
- 27.—Classified list of stations of the Signal Service.
- 28.—Annual meteorological summaries (forms 122 B) at stations of the Signal Service.
 29.—Table showing mean range of atmospheric pressure at stations of the Signal Service.
- 30.—Table showing mean of maximum and mean of minimum temperatures at stations of the Signal Service.
- 31.—Table showing mean monthly temperatures and departures of 188, therefrom at stations of the Signal Service.
- 32.—Tables showing mean daily range of temperature at stations of the Signal Service.
 33.—Table showing monthly and annual mean temperatures at volunteer stations.
- 34.—Table showing monthly maximum and minimum temperatures and annual range of temperature.
- 35. —Table showing the monthly maximum and minimum temperatures and the annual range of temperature at military post hospitals.
- 36.—Table showing monthly and annual mean temperatures at military post hospitals.
- 37.—Table showing monthly and annual mean temperatures at stations on the Central Pacific and Southern Pacific Railroads.
- 38.—Table showing monthly maximum and minimum temperatures and annual range of temperature at stations on the Central Pacific and Southern Pacific Rail-
- 39. Table showing the mean of the maximum and minimum temperatures of the cotton-region stations of the Signal Service.
- 40.—Table showing the average temperature of the surface of the ocean at stations of the Signal Service.
- 41.—Table showing the normal precipitation and the departures of that for 1885 therefrom at stations of Signal Service.
- 42.—Table showing the monthly and annual precipitation at volunteer stations of the Signal Service.

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- 43.—Table showing the monthly and annual precipitation at military post hospitals.
- 44.—Table showing the monthly and annual precipitation at stations on the Central Pacific and Southern Pacific Railroads.
- 45.—Table showing precipitation at the cotton-region stations of the Signal Service.
- 46.—Table showing the monthly maximum and minimum temperatures and precipitation at third-order stations of Signal Service.
- 47.—Table showing the mean maximum and mean minimum temperatures and the number of days of precipitation at third-order stations of the Signal Service.
- 48.—Table showing the mean relative humidity at stations of the Signal Service.
- 49.—Table showing dates of first frost at stations of the Signal Service east of the Rocky Mountains for the winter of 1885-'86.
- 50.—Table showing date of the last frost at stations of the Signal Service east of the Rocky Mountains for the winter of 1885-'86.
- 51.—Table showing the average movement of the wind at stations of the Signal Service.
- 52.—Table showing average cloudiness at stations of the Signal Service.
 53.—Table showing the average number of clear, fair, and cloudy days at stations of the Signal Service.
- 54.—Table showing the dates of closing of navigation on lakes and rivers at selected stations of the Signal Service.
- 55.—Table showing the dates of opening of navigation on lakes and rivers at selected stations of the Signal Service.

APPENDIX 1.

REPORT CF THE OFFICER IN CHARGE OF THE DIVISION OF MILITARY SIGNALING.

SIGNAL OFFICE, WAR DEPARTMENT, Washington City, July 4, 1886.

SIE: I have the honor to submit the following report of the operations of the military signaling division for the year ending June 30, 1886: On the recommendation of the Chief Signal Officer, the Adjutant-General issued orders (General Orders, No. 109, 1885) on October 12, directing that instructions be given and practice had in military signaling at all military posts, and that monthly reports be rendered to the Chief Signal Officer. Suitable forms for reports were at once prepared, and a supply sent to each acting signal officer. At this office the practice in field signaling was continued until November 1, a daily detail being made for that purpose. A company of thirty carefully selected men was enlisted for the purpose of making them experts in all kinds of signaling, and having them ready at a moment's notice for field duty. This company is now under instruction at Fort Myer, except two of its members, who are serving in Arizona with General Miles. During the latter part of 1885, the advisability of adopting a new code suitable to all kinds of visual signaling was considered, and on recommendation of the Chief Signal Officer a board was appointed, consisting of the Chief Signal Officers of the Army and of the Navy, and other officers, to select a suitable code. As a result the Continental Morse Code was adopted in orders from the Adjutant-General's Office for use in and between the Army and Navy. The same order prohibited the use of any other code.

New code-cards were at once issued to the Army and Navy, and a new cipher disk (also adopted upon the recommendation of the board) was supplied to both services.

During the year many experiments and tests were made with a view of improving on the old signal equipments, and upon the recommendation of the Chief Signal Officer, a board, consisting of Major Volkmar, Lieutenant Dunwoody, and Lieutenant Maxfield, was appointed to consider and report upon new equipments devised by Lieut. B. M. Purseell, Signal Corps. After several severe tests, the board found these new equipments were in many respects superior to the old, but was not willing to recommend their adoption until fully tested by actual use in the field. On the recommendation of this board 25 sets of the new equipments are now in course of construction, and will be sent to the different military headquarters for final test.

The manuscript of a new manual of signals was prepared early in the fiscal year, but it cannot be submitted for action until the question of the adoption of new equipments is finally settled.

During the year 346 requisitions for signal equipments, stores, &c., were received and action taken thereon. The issues to military posts consisted of:

* •	
Kit casesNo	62
4-foot flagsdo	218
2 foot flags do	42
Jointed staffs do	127
Haversacks, pliers, and scissorsdo	73
Canteens and funnels.	58
Flying and foot torches, together with the necessary extinguishers, flame-shades,	90
and wormers	62
Manuals of signalsdo	35
Wandsdo	294
Balls of wickingdo	685
Boxes of matchesdo	253
5 gallon oil-cansdo	2
Oilgallons	193
TelescopesNo	42
31	
~-	

Marine-glasses No.	19
Heliographs dodo	19
Sounders	
	v6
Keysdo	62
Relaysdo.	8
Switch-boarddo	1
Lightning arrestersdo	3
Telephonesdo.	11
Pairs climbersdo_	2
Cutting-pliersdo	13
Vicesdo	3
Double connectorsdo_	12
Wrenchdo_	1
Electric call-bellsdo	20
Transmittersdo	2
Galvanized and insulated wire (about)feet	56, 000
Eagle (round) batteriesNo	117
Leclanché cellsdo.	10
Sulphate of copperpounds_	609
Sal Amoniac dodo	27
Extra zincs	73
Insulatorsdo	72.;
Insulator bracketsdo	541
Spikesdo	50
Compasses	2
A nemometerdo	ĩ
Camp-stoolsdo_	4
~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	- 3

In addition to the above there were sent to General N. A. Miles, commanding Department of Arizona, during the months of May and June, 34 heliographs, 10 telescopes, 30 marine glasses, and 1 aneroid barometer. These were sent partly from this office and partly from military posts. Eleven men were also ordered to report to him for purposes of signaling in connection with his Indian campaign.

During the year 669 reports of instruction and practice in military signaling were received from military posts.

The following is a summarized statement of the number of officers and men who received instruction in military signaling at the various military posts since the month of March, when the instruction in the new code, referred to above, began:

		March.		April.		May.		ne.
Departments—Posts.	Ощоеть.	Men.	Officers.	Men.	Officers.	Men.	Officers.	Men.
Department of the East: Wayne, Mich	0010000000201011.1020101	8 0 18 4 0 8 18 9 7 7 4 10 2 5 0 8 8 8 6 4 6	200100000000000000000000000000000000000	5084688611668611144950443866421	2001000000201011010201010	5 0 3 4 6 8 8 6 6 10 6 8 4 11 4 9 3 5 8 9 8 8 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6	200100000020011010201020	5 13 4 6 8 8 17 7 5 9 10 4 4 7 7 8 11 4 4 8 5 8 3 4 14 8 8 5 5

[.] Also two companies.

[.] Entire command,

[.] Batteries D, G and L.

	Mai	reh.	Ap	ril.	May.		June.	
Departments—Posts.		Men.	Officers.	Men.	Officers.	Men.	Officers.	Men.
epartment of Dakota:					172		15	1
Abraham Lincoln, Dak	0	3	0	4	0	8	0	
Bennett, Dak Meade, Dak	0	8	0	8	9	8	0	1
Buford, Dak	2	6	2	6	1	6	ô	1 7
Custer, Mont	0 8	0	īJ	8	•	•	ĭ	2
Keogh, Mont.	8	18	2 1 8 0	15	2	8	1 2 0	1 1
Pembina, Dak Randall, Dak	Ŏ	6	0	21	٥١	21	0	2
Sisecton, Dak	0	8	0	8	91	7 8	0	1
Poplar River, Mont.	8	14	8	14	افا	13	8	1
Snelling, Minn	0	17	ŏ	17 l	2 0 0 1 8	17	8	ī
Solly, Dak	0	4	0	4.	0	4	0	
Totten, Dak.	0	4	0	4	0	.8	0	
Yates, Dak	Ŏ,	. 0	o l	2	9	10	•	i
Maginnis, Mont	0	8	0	8	1 2	8	1 2	
Ellis, Mont	8	6	ŏ	6	51	6	ō	
Missoula, Mont	ĭ	š	ĭl	š	ĭΙ	š	ĭ	
Shaw, Mont	2	8	2	8	2	7	2	
partment of the Platte:		ا۔	_		٠.١			
Bridger, Wyo	1	6 8	1	16	1	16	1	1
D. A. Russell, Wyo Douglas, Utah	ől	ő	4	10	ōl		٥l	
Fred Steele. Wvo	0 1 0	8	1	8	2	6	2	
Larnmie, Wyo	0	0	0	0	ō	0	3	
McKinney, Wyo	ō	0	•	-:1	•	•	•	•
Niobrara, Nebr	0 1 0	14	0 1 0	14	8	14	0	
Omaha, Nebr	7	12	7	12	81	12	8	,
Sidney, Nebr	2	7	8	6	2	7	3	
Washakie, Wyo	ī	6	ĭ	6	ī	6	ī	
partment of the Missouri:			_ ]			_	- 1	
Elliott, Tex	7	11	7	11	0	5	:	9
Gibson, Ind. T	8	6 7	8	6	8	6	, o	7
Reno, Ind. T Biley, Kans	ŏ	ó	ŏ	7	ŏl	ő	8	
3ill. Ind. T	1	6	ĭ	6	ŏl	4 8	ŏl	ì
Supply, Ind. T	1	8	Ō	8	1	8 ]	1	
Hays, Kans	0	9	1 0 0	8 7 10	0	.7	0 1 0	10
Leavenworth, Kans	Ö	8	8	10	0	10	8	10
Lyon, ColoCantonment on Uncompangre, Colo	ŏ	ŏ	ŏ	8	ŏ	ŏ	ĭ	š
partment of Arizons:			- 1	ł				
Beyard, N. Mex	0 1	.0	0	0	0	0	•	•
Bliss, Tex	0	17	o l	0	0	0	•	
Marcy, N. Mex Selden, N. Mex	0	6	8	0	0	6		, i
Union, N. Mex	7	6	ă l	6	2	6 8 8		
Lewis, Colo	ī	8	8	81	11	8	•	
Stanton N Mer	4 1 0 2 0 0 0	4 5	ō	8	0	8	•	
Wingate, N. Mex.	2	5	0 2 0	8	2	5		
ADECDE, ATIZ	2	8	8	8	0	8		
Bowle, ArizGrant, Ariz	81	ŏ	ŏ	ŏ				
Huschues, Ariz.	٥١	ŏ	ŏ	ĕ	ō	26	- 1	
Lowell, Ariz		• ]	0	0	0	0 1	•	
McDowell, Ariz.	0	0	0	0	0	0	•	
Moiave, Ariz	o l	4	Ó	4	0	4.1	0	
Thomas, Ariz	o l	Ō	0	0	0	0	0	(
Whipple Barracks, Ariz	0	8	0	8	0	8 8	:	
partment of Texas:	ļ	- 1	J	ļ				
Brown, Tex	1	10	1	9	1	8	9	0
Clark, Tex	0	6	2 0	6	2 0	6	1 0	4
Davis, Tex	ŏ	٥I	ŏ	ŏ	öl	ŏ	ŏ	ŏ
Del Rio, Tex	0	0	0 1	0	0	0 [	1	10
McIntosh, Tex	0	0	0	0	0	0	0	0
Peña Colorado, Tex	0	9	0	9	Ŏ.	0	0	Ŏ
Hancock, Tex	Ŏ	4 0	o l	4	0	4	8	4
Ringgold, Tex	0	ö	8	8	ö	4		
Stockton, Tex	ŏ	ŏ	ŏ	ŏ	ŏ	3	ŏ	ō
A Description had a		ors ero	•	-	•	•	- •	•
<ul> <li>Reports missing.</li> <li>Instruction had, but no names given.</li> </ul>	r omo	OTS SITE	~ non-	· ·	التالانجمد	- MIL		

	Ma	March.		April.		Мау.		June.	
Departments—Posts.	Officers.	Men.	Officers.	Men.	Officers.	Men.	Officers.	Men.	
Department of Columbia:  Boisé Barracks, Idaho	0 1 0 0 1	0 4 12 8 0 8	0 0 1 0 2 1 0 0	0 4 11 8 8 8	0 0 1 0 1 0 0	0 7 10 0 8 8	0 0 0 2 0	0 6 8 8 5	
Department of California. Alcatras Island, Cal. Angel Island, Cal. Benicia Barracks, Cal. Bidwell, Cal. Gaston, Cal. Halleck, Nev. Winfield Scott, Cal. Mason, Cal. Presidio of San Francisco, Cal. San Diego Barracks, Cal. West Point, N. Y. Willets Point, N. Y. Myer, Va.	00000000	0 0 8 8 0 0 6 6 0 0 27 42	000010000000000000000000000000000000000	11 0 8 4 0 12 4 6 8 0 26	000000000000000000000000000000000000000	12 0 8 4 0 15 8 10 6 0 0	000000000000000000000000000000000000000	0 0 8 2 0 0 8 14 9 5 0 0 0 4	

<sup>Reports missing.
Instruction in old code.</sup> 

Much valuable information was collected from abroad during the year in regard to military signaling, and fourteen translations were made from German, French, and Danish papers upon that subject.

Very respectfully, your obedient servant,

B. M. PURSSELL, Second Lieutenant, Signal Corps, U. S. A.

The CHIEF SIGNAL OFFICER U. S. ARMY.

OFFICE CHIEF SIGNAL OFFICER, August 6, 1886.

In view of the failure of Congress to provide for the maintenance of the school of military signaling at Fort Myer, Virginia, during the current year, I submit the following postscript to my report dated July 4, 1886:

With the abolishment of Fort Myer, Va., as a school of instruction for the Signal Service, the Army has been deprived of the means to properly maintain and improve this important branch of the service. Every civilized nation recognizes the necessity of an organized field telegraph for strategic and tactical purposes of modern warfare, and it is urgently recommended that the post again be placed under the control of the Chief Signal Officer, not only for the purpose of instructing the enlisted force of this service in its meteorological duties, but mainly because Fort Myer offers great facilities for the maintenance and further improvement of the field telegraph and visual signaling. The German general, von Chauvin, fully recognized the necessity of an organized signal corps when he said: "As every other branch of the army intended for military actions marches to the battle-field fully prepared by uninterrupted drills in time of peace, the same must be done in case of the field telegraph. All arms are being perfected, and are increased, and the same care must be bestowed upon the field telegraph. From experiences in the last campaign (Franco-Prussian war, 1870-'71), and in view of the progress of other armies, the necessity of organizing, in peace time, a field telegraph corps shows itself forcibly, and in this way only can the field telegraph succeed in complying with the materially increased requirements of modern warfare." It cannot be denied that a neglect of this branch of the military service may have serious consequences, which would be keenly felt should the United States become involved in any conflict with foreign powers. Below I propose to show briefly the organization of the military telegraph of foreign powers and improvements made by them to keep abreast with the times.

It will be observed that the organization of the military field telegraph differs in different countries. Thus, for instance, Spain, inclosed by chains of mountains, has intro-

<sup>Cadets.
All officers and men practicing in field.</sup> 

duced and organized a mountain telegraph, i.e., the telegraphic supplies are transported by mules instead of wagons, as is done in more level countries; and the topographical conditions of Austria require for the Austrian field telegraph formation the greatest We find, therefore, in that country not only permanent and semi-permanent lines, but also field and mountain telegraph systems, including the optical and acoustic telegraph. Other causes of variation in the organization are found in the systems of recruiting. In countries where the government has control of the state telegraph the personnel is recruited from the operators, while some countries have purely military and others a mixed personnel.

France.—In this country the field telegraph corps is formed only with the outbreak of a war. The management of the whole is conducted by officials of the state telegraph, and the necessary work is done by civilians without the assistance of officers. are only used as train escorts and patrols. Only such civilians are recruited from the state telegraph as belong to the reserve of the army; they are subject to military law and have all rights and duties in common with the soldier. The field telegraph directorgeneral is under the orders of the commander-in-chief of the army and is stationed at headquarters. Upon mobilizing the army a field telegraph corps is at once organized for each army corps, and comprises the following elements:

Field telegraph direction.
 Field and mountain telegraph sections.

3. Semi-permanent telegraph sections. 4. Means of transport which may be furnished by the proper military authorities.

5. Sufficient personnel and material for the service of state, fortification, field, and reserve lines.

The sections of the field and mountain telegraph and six sections of the semi-permanent telegraph are permanently organized, but are only mobilized in case of war, and take part in the great maneuvers of the army corps by direction of the secretary of war. The former sections are charged with the maintenance of telegraphic communication between operating bodies of troops, and the latter's duties consist in connecting the field lines with the state telegraph. The number of sections to be attached to a singly operating army depends upon the strength of the army, but each section consists

of one chief of section, three chiefs of station, nine operators, and twenty-six laborers.

Lately important progress has been made in the advance-post-telegraph service, and forty cavalrymen are sent each year to the school at Saumur to be instructed in mili-tary telegraphy. These men are selected after examination in reading, writing, and arithmetic, and receive, after having faithfully served their enlistment, an appointment in the state telegraph department, to be again taken into service in the field telegraph at the outbreak of a war. In addition to this school of instruction for enlisted men, a new branch of military telegraphy has but recently been added to the course for officers at the "École Militaire Supérieure."

Austria.—Austria was one of the first countries to create a field telegraph. As early as 1852 and 1853 the war department had a field-telegraph-station wagon constructed which took part in the military exercises. The management of the field telegraph is under supervision of officials of the state telegraph, who also perform the station duty, and soldiers were used for the transport of material and building of lines; but this organization was modified by an imperial order in 1883, which created a regiment of railways and field telegraphs. In time of peace this regiment consists of two battalions of four companies each, and eighteen non-commissioned officers and soldiers of each of these companies and about twenty volunteers of one year are in each year especially prepared for the telegraph service. In case of war this regiment is organized as follows:

Three directions of field telegraph of the first line.

Three directions of field telegraph of the second line.

Forty-three sections of field telegraph. Three sections of mountain telegraph.

Seven companies of the regiment form forty-two sections of field telegraph, and the eighth company forms one field section and three mountain sections. These latter three sections operate in mountainous countries, and telegraph material is carried by pack animals. Each field section comprises 1 officer and 52 enlisted men, and each mountain section 1 officer and 30 enlisted men. Each direction of the first line consists of 2 officers and 4 men (1 operator and 3 orderlies), and each of the second line of 2 officers and 3 men (1 operator and 2 orderlies), while the whole is under supervision of a director of telegraphs, with a captain as assistant.

Germany.—The organization of the military telegraph in Germany resembles much that described for France. There are no special troops as operators, and in time of war this service is performed by employés of the telegraph department; but the lines are built by pioneer soldiers, and the supervision of the line-works is in the hands of engineer officers. At the outbreak of the Franco-Prussian war in July, 1870, there were in Prussis 4 field and 3 semi-permanent telegraph divisions; these, however, were soon found

to be insufficient, and 3 additional field and 2 semi-permanent telegraph divisions were formed. Including the Bavarian and Wurtemburgian telegraph troops, the entire corps consisted of 10 field and 5 semi-permanent telegraph divisions. In the Prussian army each field telegraph division consisted of 4 officers, 1 surgeon, 7 civilian operators, and 135 non-commissioned officers and privates; each semi-permanent field telegraph division consisted of 2 officers, 21 civilians of the state telegraph, 24 laborers, and 87 non-commissioned officers and privates. This corps in the short space from June 16, 1870, to August 10, 1871, constructed 1,785 kilometers of field lines, 804 kilometers permanent, and reconstructed 8,285 kilometers of telegraph lines, and the number of stations established amounted to 611. Since then 50 complete advance-post telegraphs, at present used for fortification service, have been introduced, and a war telegraph inspection cre-This permanent inspection of the military telegraph is stationed at Berlin, and consists of a colonel, a major, and 4 engineer officers. It has charge of the telegraph material, testing of new inventions, study of the organizations of foreign military telegraphs and kindred subjects.

In 1875 the total personnel of the field-telegraph column consisted of 36 engineer officers, 12 train officers, 84 telegraph officials, 1,080 pioneers, and 600 train soldiers; adding to this the surgeons and laborers, the total strength would be nearly 2,000 men.

Russia.—This country has a permanent telegraph corps, which is completed at the outbreak of a war. Civilians of the state telegraph are only used in the second and third line of the field telegraph. In 1873, when the army was reorganized, seven field telegraph parks were created, stationed at St. Petersburg, Warsaw, Riga, Tiflis, and Kiew. Each park consists of 3 divisions, viz, 1, flying division; 2, semi-permanent division; and, 3, reserve division; and each division has a strength of 1 officer, 3 non-commissioned officers, and 35 privates. The organization of a galvanic service of the engineer corps in 1884 proves the great appreciation in which the telegraph is held in higher military circles. This service examines all discoveries and inventions relating to telegraphs. mines, and torpedoes, and gives advice upon their adoption for army use.

England.—Civilians are entirely excluded from the organization of the field telegraph. The permanent corps is formed of Division C of the Royal Engineers, and is called "Royal Engineer Telegraph Corps." Besides this corps, two companies of the Royal Engineers are always under instruction in telegraphy at the Chatham Telegraph School. The corps is stationed at Aldershot, and is exercised daily in train drill and station duty, and takes part in the maneuvers. It consists of 6 officers and 245 men. Strategi-

cally, the English field telegraph is divided into four well-defined branches:

State and fortification telegraph.

Semi-permanent telegraph.

3. Field telegraph.

Visual signals with flags, torches, lights, &c.

The troops receive thorough instruction in telegraphy in all its branches at the school at Chatham. From March, 1869, to April, 1872, 209 officers and 322 men received a course of instruction at this school.

Spain.—Until 1876 the telegraph service in the Spanish army was performed by civil employés, but at this time a new regiment (El Regimiento Montado) was formed from the then existing engineer troop, consisting of pontoneers, railway troops, and the field telegraph personnel.

The "Regimiento Montado" is divided into two battalions of four companies each. Two companies of the second battalion form the field telegraph corps, each having a strength of 4 officers and 233 men. Each company is divided into four sections, and the eight sections of the telegraph corps carry sufficient material (upon the backs of packanimals) to construct a cable line of 220 kilometers in length, and to establish 32 telegraph, 32 heliograph, 40 acoustic, and 8 advance-post stations.

The recruits, after enlistment, have to undergo a practical and theoretical course of

instruction in electric and visual telegraphy until fitted for the duties required of them.

Belgium.—The Belgian field-telegraph corps is composed of two companies, each consisting of 4 officers and 81 men, which force, in case of war, is increased to 209 men. One of these companies has charge of the state lines, which during war may be taken for military purposes, and the other has charge of the field telegraph. The term of service of these operators is three years, and during this time the men receive constantly thorough practical and theoretical instruction in the different branches of their service.

Holland.—The Dutch army has a battalion of sappers and miners of eight companies, one of which is a company of railways and telegraphs and constitutes the telegraph and signal corps of Holland. This company, in time of peace, consists of 6 officers and 184 men, and, when mobilized, is increased by recruiting from volunteers and employés of the state telegraph, who must be acquainted with the manipulation of telegraph instruments and optical signals.

Italy.—The military telegraph service of Italy consists of six companies of the regular army, divided into two divisions of three companies each, and of two companies of

militia-men, the whole belonging to the third regiment of engineers.

Each company, in time of peace, consists of 4 officers and 112 men, which numbers are increased to 6 and 250 respectively, when the company is placed on war footing. One of these companies is stationed at Rome and the five others at Florence, and each re-

ceives annually special technical instructions in telegraphy. Sweden. —In 1871 a field-telegraph corps was created in Sweden, consisting of one com-

pany, after experiments had been made in the two preceding years by the engineer corps as to the telegraph material most suitable for the circumstances of that army. signal company is stationed at Stockholm and consists of 4 officers and 124 men. placed on war footing as many subdivisions are made as may be required, but each will have a strength of 1 officer and 77 men. The training of the telegraph soldier consists of a general military, technical, and mental culture, besides of drilling in the duties of the trained soldier, namely:

(a) General military training consists of general military service and army organization; sanitary instruction; infantry drill; science of arms and target practice; march-

ing; gymnastics and guard duty.

(b) Technical training consists of practical geometry, mechanics, and surveys; pioneer service and field-telegraph service.

(c) Mental training consists of reading, writing, and arithmetic.

Portugal.—According to the military law promulgated in 1884, the Portuguese arm y comprises a regiment of engineer troops, consisting of two active battalions of four companies each, and one reserve battalion, also containing four companies. The second company of the second battalion constitutes the telegraph corps of the Portuguese army. The operators of this company are, when in the field, placed directly under the orders of the commander-in-chief.

Stoitzerland.—The military telegraph service in Switzerland is performed by the engineer corps, consisting of eight battalions. Each of them constitutes a company, which is divided into two sections, namely: that of telegraphs and that of railways. The duties of the former consist in establishing and manning field-telegraph lines, and those of the latter in the destruction and rebuilding of railways. The personnel of a telegraph section comprises 2 officers and 38 men, including 9 operators, and carries sufficient material for the construction of 20 kilometers of line.

Turkey.—During the Turko-Russian war Turkey had no organization for a militarytelegraph service, and civilian employés performed that duty; but in 1882 a German envoy was sent to Constantinople at the request of the Turkish Government, with a view to reorganize the Turkish army. According to the proposed reorganization the Turkish army was to consist of thirteen army corps, each containing one telegraph company.

is not known, however, at this writing, whether this proposed reform went into effect.

Rosmania.—The engineer troops of the Roumanian army comprise four battalions of five companies each.

The first company of each battalion constitutes the telegraph and railway company. The administrations of telegraphs designates the force and material necessary to complete the telegraph sections at the breaking out of a war, and the per-

sound is recruited from the reserve and from the militia.

Servia.—The successive transformations in the Servian army since the Turko-Russian war, have always had a tendency to increase the military force of the new kingdom. When, therefore, the army was reorganized with the beginning of the year 1883, the force of the standing army, which was 9,524, was a little more than doubled. In case of war, the call upon the reserve increases the army of the first line to about 107,000 men, and to this army there are assigned two telegraph sections, which are formed at the moment of mobilization.

Greece.—According to the laws of 1881, regulating the organization of the Greek army, the telegraph duty in the field is performed by 18 civilian employés attached

to the command of the army.

Norway.—There is at present no regularly organized field telegraph or signal corps in Norway, and the duties pertaining to that branch of service are performed by the engineer brigade.

British India.—In India there exists a permanent military telegraph company which at the breaking out of a war is completed by qualified military operators who have received instruction either in England or India, and by state telegraph officials, and this force is regulated according to circumstances and the needs of the service. Much use is made of optical signals, flags by day, torches by night; and heliograph by day and night have been found very valuable in the Indian campaigns, and the troops of all the regiments are instructed in these duties.

Japan.—The field telegraph corps of the Japanese army was first organized in 1880 and placed under the control of the general staff. According to the present form of organization operators and men are chosen from among volunteers only who have passed the required examination, and the term of service is seven years. The operators and line-men, after entry into the service, receive a special course of instruction, that of the former lasting one year and that of the latter six months. This corps has also charge of the transmission of military messages by means of optical telegraphy. The total force of this corps, including officers, reaches 207, which number is increased to 373 in time of war.

# APPENDIX 2.

# RULES AND REGULATIONS FOR THE INDICATIONS DIVISION.

Instructions ) No. 34.

SIGNAL OFFICE, WAB DEPARTMENT, Washington, July 15, 1886.

1. The rules and regulations for the indications division (Instructions No. 22, series of 1885) are amended to read as follows, to take effect August 1:

2. Before taking charge of the indications division the officer assigned will report to

the Chief Signal Officer for instructions. (Ins. 13, 1884.)

3. The indications officer will have charge of the division for the preparation of synopsis and indications, which will be designated as the indications division. He will carefully scrutinize the charts and latest reports and call the especial attention of the indications board to all meteorological conditions requiring their action under the regulations, and will at all times keep himself informed of all regulations and orders referring to the work of the division.

4. The duties of the indications officer will not be assumed by another officer or assistant except in an emergency; in which case he will report the fact to the Chief Signal officer at the next office hour, and the officer or assistant whose duties have been assumed will, at his earliest opportunity, make a detailed report, in writing, of the cause of his absence, and in case of illness the statement will be accompanied by a medical certificate, as prescribed in paragraph 2, page 45, of the General Regulations. (Ins. 2, 1886.)

5. He will report for duty in the indications division at 9 a. m., 12 m., 5 p. m., and

11 p. m. each day.

6. He will examine the reports carefully to discover telegraphic errors; note all such errors and call upon the telegraph division for corrections when they are necessary and can be obtained. When errors or doubtful reports are discovered during the preparation of the charts the translator will at once call for a repetition of the report when practicable.

7. The indications officer will call for special telegraphic observations to be taken at

such stations and at such times as he may consider necessary. (Ins. 74, 1884.)

8. He is strictly required to draw his own isobars, isotherms, and storm-tracks upon the weather chart (No. 1) used in preparing the synopsis and indications.

9. He will verify and correct the copy or proof of the synopsis, indications, and special bulletins, seeing that the text is clear and legible, and will attach his signature to the file copies kept in the indications division. He will also see, as far as may be in his power, that the indications and special bulletins are given the widest publication where

they may be useful.

10. The indications officer, during his tour of duty, has charge of, and is responsible for, not only the promptness and correctness of the indications, but for the timely delivery of the copies of the same to their several destinations in this city, and for the prompt and correct printing and delivery of all maps, charts, and bulletins at this office growing out of, and connected with, his duties, and, so far as is necessary to their proper performance in the same sense that an officer of the day at a military post has authority, he is authorized and directed to assume such control as will enable him to perform all these duties correctly, and for which he will be held strictly accountable. (Mem. 32,

11. A single copy of the synopsis will be sent to the publications division by 9.30 a. m., the complete synopsis and indications not later than 9.50 a. m., and the special bulletin, when issued in the morning, by 9.55 a. m., and the indications for the midnight

report will be completed and ready for the messenger by 12.45 a. m.

12. For the morning weather chart the indications officer will make tracings of the isobars, isotherms, and storm-tracks, from the original charts of the 7 a. m. report, as soon as practicable, preferably before the completion of the indications. These tracings will be sent to the lithographing room by or before 9.30 a. m. daily. He will give close attention to the morning weather chart until it has been actually completed, seeing that all through its several stages the work is correctly done, and leaving no chance

for errors. For this purpose he will visit the printing room and inspect the chart when it is first struck off and verify it before allowing the edition to be printed. (Ins. 140, 1884.)

13. He will compare each tri-daily indications of the previous day with the conditions exhibited on the succeeding charts covering the time for which the indications

are made.

- 14. He will particularly notice, in connection with the study of charts, the rain and dry-wind charts, the charts and tables of normal temperatures and normal barometric pressures and the barometric oscillations for the several stations, the charts exhibiting average direction of translation of low barometers (storm-tracks), the Monthly Weather Review and its charts, and the file of tri-daily charts and prevailing wind-directions. These charts should be examined in reference to the corresponding month of preceding years, and to the months preceding and succeeding the current month. Particular attention should be given to the study of the cloud-areas and the depression of the dewpoint as affecting probable changes of temperature and rainfall and the occurrence of frosts.
- 15. He will see that the mounted messenger is present, with horse saddled, at the moment the indications are ready, and that he starts immediately at a rapid pace; any failure in this particular will be reported in writing. (G. O. 28, 1873; Ins. 29, 1876.)

16. A messenger will report to him each morning at 8 o'clock in the indications division, and continue under his orders until after the completion of the morning duties.

(Ins. 192, 1881.)

- 17. Messengers will not be intrusted with the delivery of the indications until they have performed this duty in company with a messenger familiar with the routine of this work.
- 18. The indications officer should sleep during a portion of the afternoon, or between the afternoon and midnight reports, as the fatigue caused by this duty is too great to permit its best discharge with only the rest which can be obtained between the midnight and morning reports.
- 19. Officers on duty in the indications division are excused, during the time of their tour, from the continuous night-watch, as noted in paragraph 3, page 80, General Regulations, 1885, but may be required to remain at the office to announce the progress of storms or other facts connected with their especial duty when necessary. (Ins. 14, 1878.)

#### REPORTS.

20. Form 434 (check-slip for indications officer) will be carefully examined by the indications officer at each report, and as each item of the report is completed it will be successively checked. The check-slips will be sent with the record-book of the indications board to the Chief Signal Officer before 12 m., daily, except Sunday. (Ins. 69, 1884.)

21. A tri-daily report of the time of completion and delivery of the daily publications of the indications division will be made in the form given below. The indications officer will lay these three reports on the Chief Signal Officer's table not later than 12 noon daily.

# [Form No. 425 g-1885.]

Date			E	Iour Messenger's name.		••••••	
Indications.	Special bulletin.	Weather and temperature.	Time delivered to messenger.	To whom delivered,	•	Time of delivery to be entered by receiver.	Signature of receiver.
********				New York Associated Press	١.		
			********	United Press Association	list.		
				Western Union Telegraph Company	Ally ys f		
********	********	*******	******	Bankers' and Merchants' Telegraph Co	Tri-daily list- always first.		
*******				Baltimore and Potomac Depot	든때		
		******		Secretary of War	)		
*******				Critic			
******		,,,,,,,,,,	74444	Star	list.	•••••	
				Post	IJ II	•••••	
				Republican	Daily		
				The Item, Alexandria. Va		•••••	
			.,,,,,,	Post-office			
*********				Journal	.		
*******			(in Jain	Herald	io		
				Capital	dey		
				Chroniele	eekly list, Sunday.		
********				Republic	ĕ.		
				Gazette			

Material for morning map delivered to printer at ——— a. m. Map completed and in hands of messenger at ——— a. m.

Messenger left at _____m.

I certify that the foregoing is a true return for the report and date named.

----, Indications officer.

Note.—The midnight indications will be prepared and delivered to the Associated Press Companies not later than 1.15 a. m. The indications officer will personally fill up in his own hand the time delivered to messenger and the time messenger left; and he will lay these reports on the table of the Chief Signal Officer not later than 12 m.

22. Action upon telegrams requesting special weather indications will be taken at once by the officer in charge of the indications division, or, in case of his absence, by a member of the indications board. (Ins. 111, 1884.)

#### PRESS REPORT.

23. Indications will be prepared at each report for all States east of the Rocky Mountains, except Colorado and the eastern portion of Dakota Territory, for which indications will be prepared at midnight only. The prediction for Texas will apply to that portion of the State east of the one hundredth meridian. When the indications are completed for any State its name will be crossed off the check-slip containing the names of States.

24. The list of addresses for the distribution of the press reports and special bulletins will be posted in the indications division and kept corrected to date. (L. R. 6679, Mis. 1881)

25. A slip similar to the form given below will accompany the morning synopsis, tracings, indications, and special bulletin sent to the publications division.

#### PRINTER'S SLIP.

	, 188
Synopsis sent to printer	a. m
Synopsis received by printer	a. m
Map sent to printer	a. m
Map received by printer	a. m
Indications sent to printer	a. m
Indications received by printer	
Special sent to printer	
Special received by printer	

26. When signals are displayed the printer's signal check (Form No. 430c), bearing check-mark opposite stations at which signals are displayed, will accompany the morning indications sent to the publications division.

27. The following designation is adopted for indications division charts, and will be written in blue pencil on the right-hand lower corner of each leaf, in each monthly book of tri-daily charts, together with the name of the officer in charge of indications, and the date and number of the tri-daily chart. The 7 a. m., 3 p. m., and 10 p. m. charts being numbered "i," "ii," and "iii," respectively: Chart 1. Weather.

Chart 2. Barometric changes.

Chart 3. Temperature changes.

Chart 4. Clouds.

Chart 5. Dew-points and local storms.

28. In the preparation of these charts, pencils of different colors, as prescribed, will be When not otherwise stated, the ordinary black lead-pencil is intended. If possible, all lines traced on these charts will be extended across the continent.

29. Charts 1 to 5, inclusive, for August 15, 1886, will be followed as models. change will be made in the form of any of these charts without the written authority of the Chief Signal Officer. (Ins. 53, 1881.)

30. Each officer in turning over the charge of the indications division to his successor

will see that the charts are completed to the date of relief. (Ins. 40, 1877.)

31. All telegraphic reports received by mail on account of being delayed at stations or at transfer offices, from any cause, will, as soon as they arrive, be translated and entered on the indications charts. (Ins. 16, 1884.)

32. On all charts, data received too late for use in current indications will be entered in blue; in such instances, the amount of precipitation, if any, will be underscored in

33. Chart corrections to reports will be given in blue by the side of the corresponding erroneous data, through which a blue line will be traced.

34. Chart 1 will show for each station: (1) temperature; (2) barometer (reduced to sea-level; (3) wind-velocity, and, when reported, the maximum velocity since last regular report; (4) the amount of rainfall (or melted snow); (5) the state of weather; (6) wind-direction; (7) ocean swell at certain sea-coast stations.

35. Isotherms, with their proper figures, will be drawn in blue for each ten degrees of temperature, in full lines; when doubtful, in broken lines.

36. Isobars, with their figures, will be drawn in red for each tenth of an inch of barometric pressure, in full lines; when doubtful, in broken lines. The words "high" or "low" will be so placed as to show the relative barometric condition of the regions

37. Except in cases of unusual gradient, isotherms and isobars will not be drawn to

inclose an area embracing fewer than two stations.

38. Storm-tracks; the position of the storm-center at the hours of observation will be indicated by a small circle inclosing a plus sign. The movement of the storm-center in eight hours will be indicated by a line of plus signs connecting the circles locating the positions of the storm-centers. These storm-tracks will be traced for the morning weather map when the location of the storm-centers can be given for three or more re-Figures above the circles for storm-centers will indicate the dates, and figures below the circles for storm-centers will indicate the hour of observation. An arrow-head in front of the circle for the last storm-center will point in the probable direction of the storm movement.

The following example is given:

39. The wind-velocity will be entered as received, in miles per hour if registered; if estimated, by writing "calm," "light," "high," &c., as the case may be. Maximum wind-velocities, when reported, will be entered in parenthesis to the right of the current

40. The amount of precipitation for the eight hours preceding the report, if any, will be entered in inches, tenths, and hundredths, underscored in blue; if inappreciable, a short horizontal line will be drawn, underscored by a similar line in blue. The absence

of precipitation will be shown by the figures 00.

41. The direction of the wind will be shown by an arrow, flying with the wind, drawn

through the center of the station circle.

42. The state of the weather at the time of the report will be shown thus: Cloudy by circle fully shaded; fair by circleone-halfshaded; heavy rain by "R."; light rain by "r."; heavy snow by "S."; light snow by "s."; threatening by "T."; clearing by "C."; foggy by "f."; hazy by "z."; smoky by "sm."; sleeting by "slt."; written within the circle. A thunder-storm will be indicated by a short horizontal line in red, within and at the bottom of the circle. Frost will be written in full near the circle and will be underscored in red, prefixed by "K" or "L" to denote killing or light, respectively.

43. The ocean swell, from sea-coast stations, will show the direction from which it comes and its character as heavy or light, thus: Heavy northeast swell, by writing by the side of the station, "Hy. NE.," or light south, thus: "Lt. S."

44. All reports received, other than the tri-daily telegraphic reports, will be entered

on the margin of the chart, with the hour of observation noted.

45. The absence of data for temperature, barometer, wind-velocity, weather, and seaswell, will be shown by a short horizontal line in the space specified for the data itself.

46. The absence of data for precipitation will be shown by writing in its place "blk."

Such absences will also be noted on the margin of the chart.

47. Data of doubtful accuracy will be questioned thus "?," and by a note on the margin of the chart; marginal notes will always be in blue.

48. When a station is reported as missing the fact will be indicated by drawing a short line within the circle.

#### CHART 2.

49. Chart 2, barometric changes, requires the following definitions of the terms used: An actual barometer is the barometer reading corrected for temperature and instrumental error only.

A reduced barometer is the barometer reading corrected for temperature and instru-

mental error, and gravity, and reduced to sea-level.

Abnormal changes in barometer (on Chart 2) are changes for eight hours, with the diurnal change for that period eliminated.

# Auxiliary Charts.

50. In connection with Chart 2 three auxiliary charts are used to show for each station, by figures in blue near the circle, the mean of the barometer readings (the normal) for each tri-daily report of the current month. These means (except for Canadian stations for actual harometer) are for the reduced barometer. Within the circle will be shown by figures in blue the difference between the mean barometer for the current and that of the preceding observation. This difference will be preceded by the sign + when the mean for the preceding observation is greater than the mean for the current observation, and by the sign — when it is less.

51. The frequency of the wind-direction for the month (including calms), at the several stations, will be shown on the a. m. auxiliary chart by arrows flying with the wind, not more than three directions being given. The order of relative frequency will be shown by blue, red, and yellow arrows, respectively. The prevalence of calms will be indicated by drawing a circumference around the circle of station of the proper color, to show the order of relative frequency; also on these auxiliary charts, isobars will be drawn in red to show each tenth of inch of mean reduced pressure, as determined for each of

the tri-daily reports of the month. At the end of the month, these charts will be pasted in the bottom of the book of charts (Chart 2).

52. The officer of the stations division will furnish, for each month, for the use of the indications officer, a table of the 7 a. m., 3 p. m., and 10 p. m. mean readings of the reduced barometer (the normal), except for Canadian stations for which means of the actual barometer will be given.

# Preparation of Chart 2.

53. On Chart 2, enter within the circle the reduced barometer from regular stations throughout the United States and the actual barometer from Canadian stations for the current report.

The difference between the current and preceding barometers, after being increased or diminished by the figure in blue within the circle on the auxiliary chart, according to its + or - sign, will be entered above the current barometer and within the circle, preceded by the appropriate + or - sign. This result will represent the amount of abnormal change in the barometer since the preceding report. Enter the difference between the current barometer and that of the previous twenty-four hours, with proper sign prefixed, within the circle and below the current barometer.

54. Lines in blue will show each tenth of an inch of abnormal change in barometer during the past eight hours, with the amount of change in figures, with the sign + to show a rise, and the sign — to show a fall; and a line in blue, of double weight, will be drawn through the points of no abnormal change for eight hours, with the signs + and

, each on its appropriate side.

55. In a similar way lines in red will be drawn to show each tenth of an inch of change in pressure in twenty-four hours, with corresponding signs and figures, and a line in red, of double weight, will be drawn through points on the chart where the pressure is the same as reported twenty-four hours previous, with the signs + and -, each on the ap-

propriate side of this line.

56. Two sets of corrections will be prepared, to be applied to the barometer reports of the first day of each month; these corrections, with proper algebraic signs prefixed, will be written without the circle, one set to be applied, instead of the differences on the auxiliary chart, to the 7 a. m. report, so as to exhibit the true abnormal changes, and the other set to the three reports, so as to exhibit the actual twenty-four-hour changes.

57. Chart 3, temperature changes, requires the following definitions:

Actual temperature is the temperature observed, corrected for instrumental error only.

A normal temperature is the mean of actual temperatures.

A temperature departure is the difference between the normal temperature and the actual temperature for a given report.

Abnormal changes in temperature (on Chart 3) are changes for eight hours with the diurnal change for that period eliminated.

# Auxiliary charts.

58. In connection with Chart 3, three auxiliary charts are used to show for each station, by figures in blue near the circle, the mean of the temperature readings (the normal) for each tri-daily report of the current month. Within the circle will be shown, by figures in blue, the difference between the mean temperature for the current and that of the preceding observation. This difference will be preceded by the sign + when the mean for the preceding observation is greater than the mean for the current observation, and by the sign — when it is less. Isotherms will be drawn in blue to show each ten degrees of normal temperature. At the end of the month these charts will be pasted in the bottom of the book of charts (Chart 3).

59. The officer in charge of the stations division will furnish each month for the use of the indications officer, a table of the 7 a. m., 3 p. m., and 10 p. m. means of the actual

temperature readings (the normal) for each station.

# Preparation of Chart 3.

On Chart 3 enter within the circle the actual temperature of the current report. The difference between the current and preceding temperatures, after being increased or diminished by the figure in blue within the circle on the auxiliary chart, according to its + or - sign, will be entered above the current temperature and within the circle, preceded by the appropriate + or - sign. This result will represent the amount of abnormal change in the temperature since the preceding report. The difference between the current temperature and that of the report twenty-four hours previous will be entered, with the proper sign prefixed, within the circle and below the actual temperature.

61. Lines in blue will be drawn to show each five degrees of abnormal change of temperature during the past eight hours, with figures, and the sign + to show an abnormal rise, or the sign — to show an abnormal fall, in temperature; and a line in blue, of double weight, will be drawn through points of no abnormal change for eight hours,

with the signs + and —, each on its appropriate side.
62. Lines in red will be drawn to show each ten degrees of change in temperature during the past twenty-four hours, with figures and signs corresponding; and a line in red, of double weight, will be drawn through points on the chart where the temperature is the same as reported twenty-four hours previous, with the signs + and -, each on the appropriate side of this line.

63. A set of corrections will be prepared to be applied, instead of the differences on the auxiliary chart, to the temperature changes for the 7 a.m. report on the first day of each month so as to exhibit the true abnormal changes in temperature.

#### CHART 4.

64. On Chart 4 show by the Signal Service cloud symbols the cloud conditions prevailing over the country. For the upper clouds, red, placed above the circle; for the lower clouds, blue, placed below the circle.

65. The area of complete cloudiness, when for more than one station, will be inclosed

by a green line and marked 4.

66. The direction of movement of the clouds will be shown by an arrow of the color

used for the clouds.

- 67. The stations at which precipitation has fallen since the previous report, and is not falling at the time of report, will be marked within, or near, the circle by a blue cross, thus X. The cross will be omitted from stations from which clouds are not required to be sent.
- 68. Dense haze or smoke will be shown, respectively, by writing within or near the circle "Z" or "SM," and light haze or smoke by "z" or "sm," in red or blue, as the conditions belong to upper or lower clouds.

69. Dense fog will be shown by writing, in blue, "F," within or near the circle, and light fog by "f."

70. On the 7 a. m. chart will be entered, within the circle, the minimum temperature for stations east of the Rocky Mountains, except Key West, Fla., and from June 1 to August 31, inclusive, the stations on, and south of, the parallel of Lynchburg, Va.

71. Isotherms in blue will be drawn for each ten degrees of minimum temperature,

as explained in Chart 1.

72. Temperatures will be compared with temperatures of the same stations for the preceding day, and the difference, prefixed by the signs + or —, to show respectively a rise or fall, will be placed immediately without the circle, and, if practicable, to the

73. A line of double weight, in red, will be traced between the + and - differences to indicate no change in minimum temperature in one day, with the signs + and -,

each on its appropriate side.

74. From May 1 to September 30, on the 3 p. m. chart, will be entered, within the circle, the maximum temperature. Isotherms in blue will show each ten degrees of maximum temperature. These temperatures will be compared with those of the same stations for the preceding day, and the difference, and sign, will be placed as required in the case of minimum temperatures.

75. A line of double weight, with proper signs in red, will show no change in maxi-

mum temperatures in twenty-four hours.

76. On the 11 p. m. chart, the character of the sunset will be shown by Signal Service symbols, i. e., by a vertical tangent, equal in length to the diameter of the circle, and drawn on the west side, in different colors, as follows, viz: Fair, by red; cloudy, by blue; green, by green; yellow, by yellow.
77. When auroras or halos are reported from stations they will be shown on this chart

by a circle drawn within the station circle, auroras in red, halos in blue.

78. Chart 5 will show for all stations (except those stations not required to send the dew-point) the weather, wind-direction, temperature, depression of the dew-point below the temperature of the air, velocity of wind at the time of observation, and the amount of precipitation.

79. The data will be entered as on Chart 1, except that the depression of the dew-point will replace the barometer. A horizontal line will be placed between the temperature

and the depression of the dew-point-thus, 54

80. Isotherms in blue, with proper figures, will be drawn for each five degrees of temerature. The isotherm of 40° will be made of double weight where it passes over a reperature. zion in which the depression of the dew-point is 8° or less. Lines in red, with proper figures, will show each five degrees of equal depression of the dew-point.

81. Carbon lines, of double weight, will separate the regions of northerly and southerly winds. The letters "N" and "S" to indicate northerly and southerly winds,

respectively, will be placed on the appropriate sides of these lines.

82. Each clerk will write his initials in the lower right-hand corner of the chart prepared by him, and he will be held responsible for the correctness and completion of such chart. Before leaving the chart he will carefully examine all figures and signs, and will correct any defects in spacing, shape, and legibility. In case of delay in the receipt of data, he will complete the lines at the first opportunity after the receipt of such data. The clerk entering late data will, at the same time, enter the eight and twenty-four hour changes. (L. R. 6679, Mis., 1884.)

# DUTIES OF CLERKS.

83. The clerical force of this division will be divided into three reliefs: The first relief from 8 a. m. until 11.30 a. m.; the second relief from 3.30 p. m. until relieved by the officer in charge; the third relief from 10.30 p. m. until relieved by the officer in

84. In the absence of a commissioned officer, the senior non-commissioned officer pres-

ent will be responsible for the discipline in the indications division.

85. The clerical duties of this division will be equally distributed, and clerks; charged with the performance of regular or special duties will be assisted by clerks who have completed the duties assigned to them.

86. The clerks will be designated as 1, 2, 3, 4, 5, and 6, with division of duty, in

regular detail, as follows:

A. M.	P. M.	Midnight.
Chart 1 Chart 2	Charts 4 and 5	Chart 1. Charts 4 and 5.

87. On the 15th day of each month, at the 3 p. m. report, each clerk will assume the duties of the next succeeding number as indicated above, except that 6 will be assigned to the duties of 1.

#### MORNING CLERICAL DUTIES.

88. The clerk preparing Chart 1 will change the calendar; prepare for use the printer's manifold map, check-slip for indications officer, tri-daily report of indications officer, printer's slip, signal-check slip, and the telegraph blanks for morning weather and temperature predictions; set up and print synopses and indications; distribute type; file a copy of the 7 a. m. indications and note on it the time of issue; note on monthly record the time of completion of 7 a. m. synopsis, printer's manifold map, indications and special bulletin, and the 10 p. m. indications; write the special telegrams and signal orders, adjust signal board as the names of stations are read from the signal orders by the indications officer; enter signal orders in record books; before leaving see that signals are properly carried forward in the signal record books, and that they agree with the display on the signal boards; enter maximum velocity and wind-direction in cautionarysignal record book; file cold-wave orders for Washington City with the observer; note that all of the tri-daily reports of the indications officer are returned by messenger, properly timed and signed, and ready for the table of the Chief Signal Officer; return papers for file in correspondence division after they are properly checked by the indications officer; see that all messengers detailed are thoroughly capable and familiar with their duties; also on Sunday send special to Professor Carpmael; place new blank in cautionary-signal record book; wind clock. Miscellaneous: keep a list, revised to date, showing the distribution of the 7 a.m. synopses, indications, and special bulletins; make requisitions for, and keep on hand, sufficient forms, stationery, printer's material, &c., for a month in advance; keep desk supplied with message blanks corrected to date; keep records of stationery expended, charts loaned, changes in detail, and absences; prepare monthly roster, and tables for reference for desk of indications officer.

Other morning duties will be performed as follows:

Writing special bulletin and noting time of issue on file copy by clerk preparing Charts 4 and 5.

Writing copy of the special bulletin on blackboard, weekly in rotation, in the following order: by clerks preparing Charts 3, 2, 4 and 5. The clerk performing this duty will, after completion, file in the indications division the special bulletin used.

Acting as clerk for indications board, except Sundays and holidays, daily, in rotation, in the following order, by clerks preparing Charts 3, 1, 2, 4 and 5.

Assisting, when necessary, in writing special telegrams and signal orders; entering in signal-record books, &c., by clerks preparing Charts 2, 3, 4 and 5.

Reading proof; correcting all forms to date, including telegraph blanks for weather and temperature predictions; preparation of auxiliary charts; noting on temperature and barometer charts the correction to be applied on 1st day of month, by clerks pre-

paring Charts 2, 3, 4 and 5.

Filing and indexing orders, instructions, and memoranda, by clerk preparing Chart 2. Preparing charts showing mean monthly temperature and precipitation and mean quarterly temperature and precipitation for use in preparation of special monthly and quarterly bulletins, by clerks preparing Charts 2, 3, 4 and 5; entering data, reported on 1st day of month, on the above normal precipitation chart, by clerk preparing Chart 1; completion of this chart by clerk preparing Chart 2; entering data, reported on 1st day of month, on the above normal temperature chart, and completion of the same by clerk preparing Chart 3.

# AFTERNOON CLERICAL DUTIES.

89. The clerk preparing Chart 1 will prepare for use the tri-daily report of indications officer and the telegraph blanks for afternoon weather and temperature predictions; enter river reports and changes, in feet and tenths, on Form No. 130, and give river changes for publication in feet and inches; set up and print indications; distribute type; file a copy of the 3 p. m. indications and note on it the time of issue; write the special telegrams and signal orders; adjust signal board as the names of stations are read from the signal order by the indications officer; enter signal orders in signal-record books; before leaving see that signals are properly carried forward in the signal-record books, and that they agree with the display on the signal boards; file cold-wave orders for Washington City with the observer; note that messenger has returned the tri-daily report of indications officer for the previous midnight; see that all messengers detailed are thoroughly capable and familiar with their duties; keep a list, revised to date, showing the distribution of the 3 p. m. indications; file Form No. 130 in the record book when completed.

The clerks preparing Charts 2, 3, 4 and 5 will, when necessary, assist in writing spe-

cial telegrams and signal orders; entering signals in signal-record books, &c.

The clerk preparing Chart 2 will keep a list, revised to date, showing the regions for which weather and temperature predictions are sent, and to what addresses, with the authority for each address stated.

The clerk preparing Chart 3 will daily prepare, for use at midnight, a set of telegraph blanks for weather and temperature predictions, dated, signed, and compared with the above list. He will also place with this set the blanks for the Canadian and general "good night."

# MIDNIGHT CLERICAL DUTIES.

90. The clerk preparing Chart 1 will prepare for use the tri-daily report of indications officer, and note that the messenger has returned the one for the previous report; notify the observer to send for the nearest assistant when the indications officer is not present at 11.30 p. m.; set up and print indications; distribute type; file a copy of the midnight indications and note on it the time of issue; when other duties will permit, write the special telegrams and signal orders; adjust signal board as the names of stations are read from the signal orders by the indications officer; enter signal orders in the signal-record books. Before leaving see that the "good nights" have been entered; that signals are properly carried forward in the signal-record books, and that they agree with the display on the signal boards; see that all messengers detailed are thoroughly capable and familiar with their duties.

The clerks preparing Charts 2, 3, 4 and 5 will write the weather and temperature telegrams, and, when necessary, assist in entering data on Chart 1, writing and entering

signal orders, &c.

The clerk preparing Chart 3 will file cold-wave orders for Washing ton City, and the Simpson message with the observer on duty in the stations division.

# PREPARATION OF SYNOPSIS, INDICATIONS, SPECIAL BULLETIN, ETC.

# The Synopsis.

91. The following statements, briefly made, are essential to the "synopsis":

The regions of the highest and lowest barometer, and, if within the limits of the chart, the location and path of the storm-center; in special cases, the direction of movement of areas of high barometer; for the several States, the weather, the temperature, and the wind direction; special temperatures whenever 15°, or more, above or below the normal; heavy minfalls in past twenty-four hours at selected stations; and all changes in the rivers, equal to or exceeding one foot, will be noted and briefly stated, thus: "The rivers have risen (or fallen) at" [here give the names of stations and amount of change]; or "de-

cidedly risen (or fallen) at ----"; or give the number of feet, where the change is remarkable. When the river is near or above the danger line or very low at an y place, all changes will be noted. When the probable changes may be of great importance, they will also be mentioned in the special bulletin. (G. O. 28, 1873; Ins. 3, 1881; Ins. 69, 1884.)

92. Special temperatures will be given as follows: 7 a. m. temperatures from June 1 to September 30, from Eastport, Montreal, Quebec, Mount Washington, Cleveland, Alpena, Duluth, Saint Paul, Denver, San Francisco, and San Diego; and from November 1 to April 30, the 3 p. m. temperatures from Washington City, Norfolk, Savannah, Atlanta, Jacksonville, Pensacola, New Orleans, Galveston, Los Angeles, and San Diego.

93. The synopsis will be prepared at the 7 a. m. report only, and will apply to the

preceding twenty-four hours. (Mem. 109, 1886.)

# The Indications.

94. The indications will be prepared by naming the States or parts of States for which each indication is made.

95. The following statements, briefly made, are essential to the "indications":

Anticipated frosts and freezing weather as far in advance as possible; changes anticipated in the rise and fall of rivers; and, at the close, the stations, or, when the display is general, the names of lakes and sections of the sea-coast where signals are displayed. (G. O. 28, 1873; Ins. 13, 1877; Ins. 46, 1881; Ins. 69 and 131, 1884.)

96. When it is possible to make the same prediction of weather, winds, and temperature apply to several States, such States may be grouped together, but States not con-

tiguous to each other will not be included in a single group.

97. Predictions will be made for the following States, which will be named in indicacations in the order given below, except that the District of Columbia will be placed first on the line in which it occurs (mem. 156, 1886); the expected conditions of weather. winds, temperature, and, in cases of decided change, barometer, for the twenty-four hours following the next telegraphic report:

States.	Prediction.
Vaine	
	· · · · · · · · · · · · · · · · · · ·
lew screey	,,,,,,,, .
intrict of Columbia	
	,
lississippi	
	***************************************
Vestern Pennsylvania	
Vestern New York	
hio	
ndi <b>ana</b>	
llinois	
astern Michigan	
Vestern Michigan	
Visconsin	
astern Dakota t	
1970	

^{*}To apply to that portion of the State east of the 100th meridian. †At midnight only.

# Special predictions.

98. At the close of the indications prepared from the 10 p. m. reports, such indications of weather, storm movements, and river changes will be added as it may be possible to make for the succeeding forty-eight hours.

99. In making special predictions the officer in charge of the indications division may

either use the names of geographical divisions or name the States.

100. New forms of expression are forbidden until approved by the Chief Signal Officer.
101. The use of the following words is prohibited in all predictions: Or, mostly, probably, possibly, pressure, partly cloudy, occasionally cloudy, occasional cloudiness, warm-wave, easterly to southerly winds, and similar expressions for wind direction.

102. When practicable, use the word "veering" when the wind changes direction

with the hands of a watch, and "backing" when it changes in the contrary direction.

# Example of Synopsis.

WASHINGTON CITY, Thursday, November 17, 18-, 7 a. m.

#### SYNOPSIS FOR THE PAST TWENTY-FOUR HOURS.

103. The storm which was central yesterday morning north of Lake Superior has moved costward and is now central in the lower Saint Lawrence Valley. The barometer is lowest north of Maine and highest in Montana. Rain has prevailed in the lake regions and the Ohio Valley, and light snows in the Missouri and Upper Mississippi Valleys. Generally fair weather continues in the Southern States and on the Atlantic coast. The temperature has risen in the Southern, Middle, and New England States, the Ohio Valley, and lower lake region; it has fallen decidedly in the upper lake region, and thence westward to the Rocky Mountains, and a "cold wave" is moving eastward from Dakota and Montana, where the temperature is about 10° below zero. Fresh and brisk southerly winds continue on the Atlantic coast. Severe southwest to northwest gales have prevailed in the lake regions, and the winds have shifted to northerly in Minnesota and Dakota, and thence southward to Texas, causing the temperature to fall from 20° to 40° in the States north of Texas.

The following special temperatures were reported at 3 p. m. yesterday: Washington City, 45°; Norfolk, 44°; Savannah, 60°; Atlanta, 54°; Jacksonville, 71°; Pensacola, 64°; New Orleans, 73°; Galveston, 63°; Los Angeles, 65°; San Diego, 67°.

The Ohio River has risen 6 feet at Cincinnati and 5 feet at Louisville. The Mississippi has risen 4.6 feet at Saint Louis, 2 feet at Cairo, and fallen slightly at Memphis and Vicksburg. The Cumberland has fallen 2.3 feet at Nashville, where it is now 3 feet below the danger-line.

# Example of Indications.

WASHINGTON CITY, Thursday November 17, 18-, 10 p. m.

# INDICATIONS FOR TWENTY-FOUR HOURS COMMENCING AT 7 A. M. ON FRIDAY, NOVEMBER 18.

104. For Maine, New Hampshire, and Vermont: Light rains; southwest, shifting to westerly, winds; lower temperature; rising barometer.

For Massachusetts, Rhode Island, and Connecticut: Fair weather, followed by rain; brisk

southerly winds, shifting to westerly; decidedly colder.

For Eastern New York, Eastern Pennsylvania, New Jersey, and Delaware: Cloudy weather and rain; warmer southerly, shifting to much colder westerly, winds, with a cold wave during Saturday.

For the District of Columbia, Maryland, and Virginia: Light rains; winds shifting to westerly; warmer, followed by colder, weather; lower barometer.

For North Carolina, South Carolina, Georgia, and Eastern Florida: Fair, slightly warmer weather; light winds, becoming southerly.

For Western Florida and Alabama: Warmer, fair weather; light variable winds.

For Mississippi, Louisiana, and Texas: Cloudy weather and rain, changing to snow in northern portions; much colder northerly winds, and a severe "norther" during Saturday; higher barometer.

For Arkansas, Tennessee, and Kentucky: Rain and snow; winds shifting to colder north-

westerly, with a cold wave; higher barometer.

For West Virginia, Western Pennsylvania, and Western New York: Rain and snow; colder northwest to southwest winds, increasing in force, with a cold wave on Saturday; higher barometer.

For Ohio, Indiana, and Illinois: Rain and snow; colder and freezing weather; brisk

and high northwest winds; higher barometer.

For Eastern Michigan, Western Michigan, and Wisconsin: Light snows; colder northwest winds, dangerous on Lakes Michigan and Huron.

For Minnesota, Eastern Dakota, Iowa, and Missouri: Light snows, followed by fair weather: colder northwest winds.

For Nebraska: Light snows, followed by colder fair weather; northerly winds, becoming light and variable.

For Kansas: Light snows, followed by colder, fair weather; northerly winds; higher barometer.

For Colorado: Fair weather; stationary temperature; light variable winds.

RIVERS .- The Upper Ohio River will fall slowly, and the Lower Ohio will rise at points between Louisville and Cairo. The Lower Mississippi will remain about stationary. The Cumberland and Tennessee will continue to fall.

SIGNALS.—Cautionary northwest signals continue at stations on Lakes Michigan, Erie, and Huron, and are ordered for Indianola and Galveston. Cautionary on-shore signals continue at stations on Lake Ontario, and cautionary southwest signals continue on the Atlantic coast from Hatterss to Boston.

SPECIAL PREDICTIONS FOR SATURDAY.—Frosts and freezing weather are indicated for the States in the Missouri Valley and thence southward to Northern Texas. Colder, fair weather is indicated for Virginia and North Carolina.

# The Special Bulletin.

105. Immediately after the completion of the synopsis and indications from the a. m. reports, a "Special Bulletin" will be prepared whenever the conditions indicate changes in any section which should receive special mention. In the bulletin no reference will with the most important feature as determined from the reports of the last twenty-four hours; will announce the approach of unusually warm weather and cold waves; of frosts; the river conditions when dangerous floods exist, or are anticipated; the movements of well-defined storms, giving the direction and naming the States where they will be most severe; the amount of unusual changes in temperature in general terms, and the current temperature at the several stations where the change has been greatest; the actual rainfall equal to, or exceeding, 1 inch in twenty-four hours for selected stations; and will contain all data relative to cold-wave signals. Storms and cold waves will be treated as specifically as possible, and their progress carefully traced and announced from day to day. (Ins. 140, 1884.)

106. The bulletin will close with such indications of weather, storm movements, and river changes as it may be possible to make for the succeeding twenty-four or forty-eight hours. The indications referring to the movements of freshet waves in any part of the country east of the Rocky Mountains, when practicable, will be given for several days

in advance, and telegraphed to the observers in the threatened districts.

107. When frosts which may prove injurious to crops are likely to occur, the bulletin will contain special warnings of their approach, which the officer in charge will telegraph to the observer at stations in the threatened districts, with directions to give them the widest distribution.

# Example of Special Bulletin.

# WASHINGTON CITY, February 25, 188-, 10 a. m.

108. A severe storm is now central over the upper lake region, moving easterly, which will cause high southerly, shifting to westerly, winds in the States bordering on the Atlantic.

A cold wave is advancing southeastward from Dakota; its influence will be felt in the lake regions, the Ohio Valley, and Tennessee and west Gulf States during to-night, and in the States bordering on the Atlantic during Friday.

The temperature has risen between 10° and 20° in the States bordering on the Atlantic,

the East Gulf States, the Ohio Valley and Tennessee, and from 20° to 30° in the lake region; it has fallen from 10° to 40° in the Upper Mississippi and Missouri Valleys, and from 20° to 30° in the western portion of the upper lake region.

The following stations report 1 inch or more of rainfall during the past twenty-four

hours: Memphis, 1.44; Grand Haven, 1.29.

Special indications for Friday.—A cold wave is indicated for the middle Atlantic States, the south Atlantic States, the Ohio Valley and Tennessee, and lower lake region. The temperature will fall from 20° to 40°.

109. The 10 a. m. special bulletin will be printed in a manner similar to the model on file in the correspondence and records division, and will be posted in frames at all places where the morning weather chart is displayed. (Ins. 46, 1881; Ins. 80, 1882.)

110. The indications officer will mark in red peucil such parts of the synopsis, indica-

tions, and special bulletins as may be of special interest.

111. In transmitting the synopsis, indications, and special bulletins, the officer in charge of the telegraph division will cause to be sent, underlined, the portions marked in red or other color. (Mem., Dec. 29, 1884, File Mis.)

# The Monthly Special Bulletins.

112. On the first day of each month the officer in charge of the indications division during the preceding month will prepare a special bulletin, in which will be incorporated general remarks on the mean temperature and total precipitation of that month and the average depth of snow on the ground at the end of the month in the several States, together with brief descriptions of damaging frosts, severe storms, &c., which may have occurred during the same period. The bulletin will close with special directions to those receiving it to give it the widest publication. A copy of the bulletin will be sent direct to the printer before 3 p. m. of the first day of the month, and will be printed in the same manner as the special bulletin. The edition will consist of 300 copies. (Ins. 87 and 108, 1884.)

113. When the month closes a season there will be given, in addition to data for the month, the mean temperature and total precipitation for the season, together with the

departures from the normal temperature and precipitation for that season.

114. The officer in charge of the stations division will furnish for the use of the indications officer the tables of mean monthly temperature and precipitation and mean quarterly temperature and precipitation.

# Example of the Monthly Special Bulletin.

#### SPECIAL BULLETIN FOR DECEMBER.

SIGNAL OFFICE, WAR DEPARTMENT, Washington City, January 1, 1886.

115. The month of December has been generally warmer than the average December temperature in all States, but the departure from the normal temperature varied only from 1° to 3° in the Northern States east of the Mississippi. In the East Gulf and South Atlantic States and in East Tennessee the temperature was slightly below the normal for the month, the greatest departure being along the east Gulf coast and in northern Florida, where it was from 2° to 3° colder than the average December temperature.

In the Northwest and at northern and central Rocky Mountain stations the month has been unusually warm, the average temperature ranging from 6° to 16° above the normal, the greatest departures being reported from Montana and western Dakota. slightly warmer in all districts on the Pacific coast and in the West Gulf States, and it was about 3° above the normal in New England and the Middle Atlantic States, while at stations in the interior of Indiana and Ohio it was slightly below the normal. The maximum departures from the normal occurred at the following stations: Above the normal, Fort Assinaboine, 16°; Fort Buford, 16°; Fort Custer, 14°.9; Deadwood, 11°.5; Helena, 10°.6; Cheyenne, 6°.1; Denver and Saint Louis, 5°.8.

Below the normal, Jacksonville, 3°; Pensacola, 5°.4; Mobile and New Orleans, 2°.1.

The mean temperature for the month at some of the principal stations was as follows: Boston, 33°; New York City, Philadelphia, and Washington City, 37°; Jacksonville and New Orleans, 53°; Chicago, 31°; Saint Louis, 40°; Denver, 36°; Saint Paul, 21°; San Diego, 56°.

The rainfall for the month has been generally less than the average, except in the cen-

tral Pacific coast region and at isolated stations in the Lake regions and Northwest, and along the East Gulf and South Atlantic coasts, where an excess of rainfall is reported. The deficiency ranged from 2 to 4 inches in the interior of the East Gulf States and Georgia, and thence northward to the Lake regions and at stations on the West Gulf coast. In New England and the Middle Atlantic States the rainfall was about 1 inch less than the average for the month. The maximum departures from the average rainfall occurred at the following stations: Below the normal, Atlanta, 3.4 inches; Vicksburg, 3 inches; Galveston, 2.8 inches. Above the normal, Jacksonville, 4.9 inches; Charleston, 2.7 inches; Savannah, 2.1 inches; Escanaba, 2 inches.

The snowfall for the month has been much less than usual, and all stations east of the Rocky Mountains reporting "snow on ground" at the end of the month were north of the forty-second parallel of latitude. Eastport, Oswego, Alpena, Saint Paul, Moorhead, and Helena report ½ inch of snow on the ground on the last day of the month; La Crosse and Fort Assinaboine, 1 inch; Marquette, Escanaba, Denver, and Salt Lake City, 6 inches.

The most severe storms of the month occurred on the 4th, 5th, and 6th, and from the 26th to the 29th, the former passing over the Lake regions from the northern Rocky Mountain regions and the latter passing along the Atlantic coast, the center at no time being within the limits of the stations of observation; each of these storms was followed by a cold wave which extended over all districts east of the Rocky Mountains. Killing frosts occurred in the lower Rio Grande Valley on the 14th, at New Orleans on the 15th, and freezing weather occurred in northern Florida on the 27th.

# WEATHER AND TEMPERATURE SPECIALS.

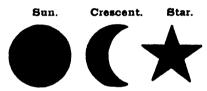
116. The indications officer will send daily, for the regions mentioned, that portion of the indications relating to weather and temperature, including cold waves and frosts, to the addresses on the list furnished to the indications division, which will be corrected monthly.

117. These messages, except those addressed to observers and to the superintendent of the Alabama weather service, Auburn, Ala., will contain, in addition to the pre-

diction, the symbols for the same.

118. The following are the symbols referred to:

# WEATHER AND TEMPERATURE SIGNALS.



Sun-higher temperature. Crescent-lower. Star-stationary.

Sun-general rain or snow. Crescent-clear or fair weather. Star-local rain or snow.

119. In case of divided predictions, the signal for weather may consist of two symbols, but the signal for temperature will consist of only the symbol representing the last portion of the prediction.

120. Messages containing the weather and temperature symbols for the midnight prediction, but with the prediction omitted, will be sent to the addresses on the list fur-

nished to the indications division, which will be corrected monthly.

121. The foregoing lists, revised to date, will be kept posted up in the indications division, and will be changed only on memorandum orders received from the officer in charge of the correspondence and records division.

122. The officer in charge will, whenever possible, telegraph probable changes in the weather in the Lake regions and Upper Mississippi and Missouri Valleys to the observer at Baltimore, Md., who will furnish a copy to the secretary of the Baltimore Corn and Flour Exchange. (Ins. 28, 1883.)

# STORM WARNINGS (SIGNALS).

123. Cautionary signals will be ordered whenever the indications officer considers it probable that there will occur within 100 miles of the station on any navigable water, a wind-velocity dangerous to navigation, i. e., reaching a velocity of 35 miles an hour. If, at the next regular report following the ordering of signals, it appears that the danger is not so imminent as to justify the display, the signal will be ordered down.

124. The following table of verifying velocities, furnished to stations of the second order, shows the velocity of the wind which should occur at any station to verify a cau-

tionary-signal display; this verifying velocity is based upon a velocity of 35 miles per

hour occurring within 100 miles of the station.

Station,	Verifying velocity.	Station.	Verifying velocity.	Station.	Verifying velocity.
Indianola.  Galveston New Orleans Mobile Pensacola Cedar Keya Key West Jacksonville Savannah Charleston Wilmington Smithyille Fort Macon Hatteras Kity Hawk	27 24 27 26 29 80 80 28 28 28 23 80 85 28	Cape Henry Norfolk Baltimore Chincoteague Atlantic City Sandy Hook New York City New Haven New London Block Island Boston Portland, Me Eastport Oswego Buffalo	20 19 84 22 35 25 23 22 85 29 28 28	Erie Cleveland Sanduaky Toledo Detroit PortHuron Alpena Mackinaw City Grand Haven Chicago Milwaukee Escanaba Marquette Duluth	27 28 28 28 27 28 27 28 33 22 28 27

(L. S., April 20 and June 17, 1886.)

125. On-shore signals will be ordered whenever the indications officer considers it probable that there will occur at any cautionary-signal station on the lakes, taking observations, winds blowing in an on-shore direction with a velocity between 20 miles per hour and the verifying velocity for cautionary signals. It will not be displayed at the same time with the cautionary signal.

126. The following table shows for each station on the lakes, taking observations, the

wind velocities for which an on-shore signal should be displayed:

Station.	Velocities.	Station.	Velocities,
Oswego. Buffalo. Erie. Cleveland. Sandusky. Toledo. Detroit. Port Huron.	20 to 82 20 to 28 20 to 26 20 to 84 20 to 26	Alpena	Miles. 20 to 26 20 to 27 20 to 32 20 to 32 20 to 21 20 to 27 20 to 27 20 to 28

127. The following table, furnished to stations on the lakes, taking observations, shows, for each station, the direction from which the wind must blow in order to verify the display of an onshore signal:

Station.	Direction.	Station.	Direction.
Toledo Detroit	SW. to NW. NW. to NE. NW. to NE. NW. to NE. N. to E.	Alpena. Mackinaw City. Grand Haven. Chicago. Milwaukee. Facanaba. Marquette. Duluth.	8W. to NW. NE. to SE. NE. to SE. E. to S. NW. to E.

(L. S., April 20 and June 17, 1886.)

128. When practicable, the indications officer will hoist a direction signal with the cautionary signal. The direction signal will be hoisted for winds expected from either of the following quadrants, viz., between north and east, east and south, south and west, and west and north. These quadrants will be known as the northeast, southeast, southeast, and northwest quadrants.

129. Signals will be ordered up in the words "Hoist cautionary and northeast," &c., or "Hoist cautionary," or "Hoist northeast," &c., or "Hoist on-shore," &c. The direction signal will be changed by the words "Change southeast to northwest," &c. Signals will be changed by the words "Change southeast to northwest," &c.

vals will be ordered down in the words "Signals down."

130. On-shore signals will be changed to cautionary in the words "Change on-shore to cautionary and northwest," &c. Cautionary signals will be changed to on-shore

signals by the words "Change cautionary to on-shore."

131. The receipt of an order to lower a signal at a cautionary station will not cause it to be lowered until the wind falls below the verifying velocity for that station. observer will acknowledge the order at once unless the indications officer directs in the order to "acknowledge when the signal is lowered." This will permit the indications officer to order down a signal as soon as he sees indications of the abatement of the storm, and thereby prevent the display of a signal after the storm has passed.

132. To provide further against the display of signals after the storm has prevailed, observers are authorized to wire the fact to this office if the wind falls below the verifying velocity during a display, provided, (1) he has no order to lower, (2) that the wind is westerly, (3) that the barometer is rising, (4) and that it is more than one hour before the next tri-daily observation. Upon the receipt of such a telegram the indications

officer will decide whether the signal should be lowered at once.

133. The indications officer will assume the undivided responsibility for the display or lowering of all signals. Conditional orders for such display or lowering will not be

issued. (Ins. 15, 1886.)

134. Whenever cautionary signals are ordered for a storm and the danger from the storm has passed, and the signals are continued in anticipation of a second dangerous storm, a special explanatory message will be sent to the stations interested. (Ins. 63,

1880.)

135. Sixteen hours on the lakes, and twenty-four hours elsewhere, is a sufficient time to hoist a cautionary or on-shore signal previous to the arrival of the storm. If a signal remains hoisted for more than twenty-four consecutive hours before the arrival of a verifying velocity on the lakes, and thirty-two hours elsewhere, it shall be considered a failure. In verifying, if the non-verified display is continued over the above-mentioned time, it shall be considered a new display. This paragraph will only apply to stations having night telegraph service.

136. On account of there being no night telegraph service at stations not taking observations, indications officers will send, if practicable, signal orders to such stations on

or before 5 p. m., daily, except Sunday, and on Sundays before 10 a. m.
137. The indications officer will send with all cautionary or on-shore signal orders, and as often during the display as he considers necessary, to the following stations: Duluth; Milwaukee; Mackinaw City; Detroit; Cleveland; Oswego; Boston; New Haven; Norfolk; Savannah; Cedar Keys; New Orleans; Marquette; Chicago; Alpena; Toledo; Erie; Eastport; Nantucket; New York City; Wilmington; Jacksonville; Penascola; Galveston; Escanaba; Grand Haven; Port Huron; Sandusky; Buffalo; Portland, Me.; New London; Baltimore; Charleston; Key West; Mobile; a telegram giving, as near as possible:

(1) The location of the storm-center and probable direction it will move.

2) The probable direction of wind in next eight or sixteen hours, and the direction it is expected to shift

(3) The probable time the storm will cease to be dangerous.

(4) The probable state of weather in next eight or sixteen hours, whether rain, snow,

or fog, and whether higher or lower temperature.

138. When cautionary signals are ordered up or down at the stations on the lakes or the Gulf, notification will be sent by telegraph to other stations in the same locality, as directed below. The notification, besides the information that "up" or "down signala," &c., are ordered for other stations, will contain so much of the explanatory message embraced in the cautionary order as will be of general importance to the stations

receiving it.

139. When cautionary signals are ordered up or down at any of the stations on the Gulf coast, viz., Key West, Cedar Keys, Pensacola, Mobile, New Orleans, Galveston, and Indianola, notifications will be sent to all of these stations, except Indianola, when the indications officer considers it probable that the storm for which the signals are ordered will cause dangerous winds in the region of the station to be notified. This paragraph

refers only to stations taking observations.

140. When cautionary signals are ordered up or down on the lakes, notifications will

be sent to stations as follows:

(1) Signals ordered on Lake Superior, to stations on Lakes Superior, Huron, and Michigan; (2) signals ordered on Lake Michigan, to stations on Lakes Michigan, Huron, and Erie; (3) signals ordered on Lake Huron, to stations on Lakes Huron, Erie, and Ontario; (4) signals ordered on Lake Erie, to stations on Lakes Erie, Ontario, and Huron, and to Mackinaw City; (5) signals ordered on Lake Ontario, to stations on Lake Ontario. cautionary signals have been ordered at one or more stations on one of the lakes and due notification has been given, notification of the ordering of additional signals on that lake will not be sent to stations on other lakes. These notifications apply to orders to display, or lower, cautionary signals only, and not to on-shore signals. This paragraph refers only to stations taking observations.

141. The kind of signal shown at Sandy Hook, N. J., will be the same as that at New

York City. (Ins. 1, 1884.)

142. All cautionary signals received at Indianola, Tex., will be repeated to the observer at Brownsville, Tex. (Ins. 19, 1885.)

143. The officer in charge may give a more extended notification of the ordering of sig-

nals when, in his opinion, necessary. (Ins. 91, 1882.)

144. Display boards showing stations where cautionary signals are up, together with the kind of signal, will be kept in the indications division. (L. R. 6679, Mis., 1884.)

145. The officer in charge will verify the orders for display and discontinuance of signals and the record on the cautionary-signal board, after which the order will be numbered and entered in the cautionary-signal order book and sent to the telegraph room.

146. At midnight, after completing the press report and special telegrams, and issuing the necessary signal orders, if any, the "good-night" message will be prepared, copied in the "signal-order book," verified, and sent to the telegraph room.

147. Cautionary signals will be ordered for Baltimore, Md., whenever a storm is anticipated on the Delaware, Maryland, or Virginia coasts. They will be considered justi-

sed if the wind reaches the verifying velocity at any station within that section.

148. The observer at Key West, Fla., is authorized, except when signals are ordered by the indications officer, to display and lower cautionary signals at that station at his discretion, reporting such action immediately by telegraph to this office. Each telegram will contain all essential information of the movement and character of the storm. 171, 1881.)

149. Cantionary-signal orders for Nantucket will be made out on Form No. 206, in the same manner as stations receiving orders direct.

150. The following form (No. 206) is used in sending signal orders:

# [Form No. 206.]

# WAR DEPARTMENT, SIGNAL SERVICE, U. S. ARMY, Washington, D. C., ——, 188—, — m.

TO CORCLACL:
Indianola.
Galveston.
New Orleans,
Mobile,
Pensacola.
Cedar Keys.
Key West,
Toolson will a
Jacksonville,
Jacksonville Section,
Savannah.
Savannah Section,
Charleston,
Wilmington.
Wilmington Section.
withington section,
Norfolk Section,
Norfolik.
Fort Monroe.
FOR MODIOE,
Baltimore,
Chincoteague,
Cane Henlonen

Sandy Hook, New York City, New Haven, New London, Newport Section. Narragansett Section, Nantucket, Wood's Holl Section, Boston. Boston Section, Portland, Portland Section. Eastport, Oswego, Oswego Section, Rochester, Buffalo, Erie.

N. J. Coast Section,

Erie Section, Cleveland, Sandusky, Toledo, Detroit. Saginaw Bay Section, Port Huron, Alpena, Mackinaw City, Grand Haven, Grand Haven Section. Mackinaw Section, Chicago, Milwaukee Milwaukee Section, Green Bay Section, Escanaba Marquette, Duluth.

Hoist	Cautionary, On-shore,	Northeast, Southeast.	Signals down.	
Change	On-shore to Cautionary, Cautionary to On-Shore,	Southwest, Northwest,		
(a) The Droper	a telegram giving, as near as possit t will move. (2) The probable dir is expected to shift. (3) The pro- le state of weather in next eight of or lower temperature.	ole: (1) The location of wind in next bable time the storm or sixteen hours, who	of the storm-center and prob- teightor sixteen hours, and will cease to be dangerous. ther rain, snow, or fog, and	
************************	***************************************	************************	***************************************	
***************		*******************		
****************	, ,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,		*************	
(Signed	1)			

Time ordered to station, -By order of the Chief Signal Officer.

# STORM WARNINGS (CANADIAN SERIES).

151. Whenever the conditions indicate dangerous weather in the Dominion of Canada. a message will be transmitted to the superintendent of the meteorological service, Toronto, Canada.

152. The following cipher will be used to indicate the districts or stations threatened: Collingwood, for Georgian Bay; Saugeen, for Lake Huron; Kingston, for East Ontario; Toronto, for West Ontario; Stanley for Lake Erie; Montreal; Quebec; Father Point; Gaspe; Bathurst; Shediac, for North New Brunswick; St. John; Pictou, for North Nova Scotia; Halifax; Sydney; Yarmouth; Newfoundland.

153. The time and date at which a storm is expected to arrive at the districts or sta-

tions threatened will be given in the words, morning, afternoon, or midnight of -

(day of month).

# Example of dispatch.

154. Storm (or severe storm) indicated for Saugeen, Collingwood, Stanley, afternoon of 4th; Toronto, Kingston, midnight of 4th; Montreal, Quebec, morning of 5th.

155. When danger is past or no longer threatens any Canadian station that has been warned, a dispatch will be sent to the superintendent of the meteorological service, Toronto, Canada, containing the following:

. (1) Safety; (2) name of station or stations; (3) time, and (4) date. A "good night" message will also be sent to the superintendent of the meteorological service, Toronto,

Canada, at midnight.

156. The officer in charge will verify all dispatches relating to storm warnings and the record on the cautionary-signal board, after which a copy of the dispatch will be en-

tered in the signal-order book. These dispatches will not be numbered.

157. On Sunday a telegram will be sent at or before 9.30 a. m., giving the following information: If there be no definite warnings for Canadian stations based on the current reports and no expectation that there will be any founded on the afternoon reports of the same day, and any warnings sent on the previous day have been acknowledged, the absence of danger will be expressed by the words "nothing coming." If the morning reports do not make the immediate issue of warnings necessary, but indicate that there is a fair probability that a warning may be necessary after the receipt of the afternoon reports, this information will be expressed by the words "Sunday evening," with the names of the stations at which the warning will probably be needed. Warnings based on the current reports will be sent in the usual manner. (Cir. 23, 1874.)

# STORM WARNINGS (MISCELLANEOUS).

158. The indications officer will telegraph to the United States Fish Commission, Wood's Holl, Mass., warnings of impending or threatened storms in the region off the south coast of New England. (Mem., July 1, 1884.)

159. The indications officer will telegraph to the secretary of the Maritime Exchange, New York City, when reports indicate the approach of severe storms toward the Gulf

and Atlantic coasts.

# SEVERE LOCAL STORMS AND TORNADOES.

160. The indications officer will give special attention to conditions favorable to the development of severe local storms and tornadoes. When the reports justify the prediction of these storms they will form a part of the general indication, the prediction to be that "conditions are favorable for the occurrence of severe local storms or tornadoes," giving the names of the States where such storms are expected to occur. (Mem. 100. 1886.)

 Whenever severe local storms are predicted, as provided for by Mem. 100, 1886, the indications officer will telegraph the prediction as a special message to all Signal Service stations, and to the directors of the Minnesota, Ohio, and Alabama State weather

services, when located within the threatened regions.

# UNUSUAL OR VIOLENT DISTURBANCES IN CENTRAL ILLINOIS.

162. Whenever the conditions indicate unusual or violent disturbance in the region of central Illinois special predictions will be telegraphed "charges collect" to the "Pantagraph," Bloomington, Ill. (Mem. 159, 1885.)

#### THUNDER-STORMS.

163. The officer in charge of indications will give special attention to the study of conditions likely to be followed by thunder-storms in the New England States during the months of June, July, and August. When thunder-storms are likely to occur a dispatch will be sent to the observer at Boston, Mass., in the following terms:
"Wednesday (or day of week), June 5 (or day of month), is appointed term-day for
the thunder-storm observers of the New England Meteorological Society."

164. These dispatches should be sent on the day previous to the one announced as the "term-day." (Mem. 133, 1886.)

# STORM WARNINGS AND IMPORTANT FORECASTS (NEWSPAPERS).

165. A list of the daily newspapers published throughout that portion of the country for which predictions are made, with the address and hour of publication for each, will be kept in the indications division for use of the indications officer when important forecasts or warnings are to be telegraphed to the publishers.

166. The above list will be furnished by the officer in charge of the stations division, who will direct the observer in charge of the station at Washington City to keep it cor-

rected to date.

#### NORTHERS.

167. When "northers" are anticipated telegraphic warnings will be sent to the regions menaced, according to the following schedule:

Co-operating railroad.	Central distributing station.	Person addressed.
Burlington and Missouri River Railroad Atchison, Topeka and Santa Fé Railroad Missouri Pacific Railway Saint Louis and San Francisco Railway International and Great Northern Railway	Omaha, Nebr	General manager. Superintendent of telegraph. Do. Do. Assistant superintendent of telegraph.
Fort Worth and Denver City Railroad	Fort Worth, Tex	Superintendent of telegraph. General superintendent. Superintendent of telegraph. General superintendent.

168. Warnings of the approach of "northers" in the Mississippi and Missouri Valleys and the Southwest will be telegraphed to the observer at Saint Louis, Mo. (Mem. 103, 1885.)

# BIVER CHANGES, FLOODS, AND LOW WATER.

169. The river reports and river changes will be recorded and published in feet and

170. Whenever the changes equal or exceed one foot they will be briefly noted in the synopsis. When the river is near or above the danger-line, or very low, at any place, all changes will be noted. When the probable changes may be of great importance they will also be mentioned in the special bulletin. (G. O. 23, 1873.)

171. The indications officer will carefully study the river changes for the previous

years, with a view of determining the rate of movement of freshet waves.

172. He will call for special telegraphic river observations to be taken at such stations, and at such times as he may consider necessary. When river reports are to be discontinued he will notify the officer in charge of the stations division, who will issue the necessary orders. (Ins. 74, 1884.)

173. Telegraphic warnings will be sent to all stations within the districts menaced by dangerous floods; when floods are likely to occur in regions where there are no stations a warning will be sent to the signal station nearest to the threatened locality, with directions to give the widest publication.

174. Reports of Western floods will be telegraphed, by special message, to the observer

at New Orleans, La. (Ins. 28, 1886.)

175. In order that proper action may be promptly taken when a dangerous rise in any navigable river east of the Rocky Mountains is anticipated, the indications officer will at once notify the officer in charge of stations when he begins telegraphing reports. He will also notify the same officer when these reports are discontinued. (Ins. 20, 1886.)

176. Whenever danger from floods in the Potomac River is anticipated, notice will be sent to the merchants of Georgetown, and to the press in Washington, &c., of such impending floods. A duplicate message will be sent by the officer in charge of indications to the superintendent of the United States carp ponds, through the Telephone Exchange and National Museum. (Ins. 17, 1884.)

# FROSTS.

177. Officers will carefully study the meteorological conditions preceding damaging frosts. Such as threaten any crop or fruit will be announced in indications and by special telegraphic bulletins as early as practicable, and, if possible, two or three days in advance. These frost warnings will define the regions threatened, state the time, and distinguish between light frosts, killing frosts, and freezing weather. The officer in charge will call upon the other members of the indications board for their opinions as to the minimum temperature to be expected and the area threatened. (Ins. 154, 1881; Ins. 155, 1882.)

178. When frosts which may prove injurious to crops are likely to occur the special bulletin will contain special warnings of their approach, which the officer in charge of indications will telegraph to the observers at stations in the threatened districts, with

directions to give them the widest distribution.

179. Whenever minimum temperatures of 40°, or less, with conditions favorable for frosts, are expected, warnings will be telegraphed to the centers named in the several schedules filed in the indications and telegraph divisions, as follows: for the fruit-growing regions, from November 15 to April 15; for the tobacco-growing regions, from September 1 to November 1, or until after killing frosts; for the sugar-growing regions, from October 1 to February 1, or until after killing frosts; for the fruit and vegetable districts about Chattanooga, Tenn., from September 15 to May 1; for districts about Georgetown, S. C., from October 1 to April 1. (Ins. 69, 1879; Ins. 128, 1882; Ins. 6, 21, 24, and 31, 1883.)

180. The frost-warnings for the sugar-growing regions of Louisiana will be telegraphed to the signal service observer at New Orleans, who will promptly furnish copies to associations interested. The officer in charge of indications will exercise great care in preparing these warnings and make them descriptive of the conditions expected to occur in the northern and southern parts of the State; he will also give the time at which the cold wave or frost will probably reach the State. Warnings will not be given unless light frosts are expected at least in the northern section of the sugar-growing region; and when the temperature will probably fall below, or to, freezing in any section of the sugar-growing region it will be so stated. (Ins. 123, 1884.)

181. Special frost warnings for the cranberry-growing regions of Wisconsin will be prepared and telegraphed to the observer at Milwankee, who will distribute them, by telegraph, to selected points in the counties of Jackson, Monroe, Juneau, Adams, Waushara,

Marquette, Green Lake, and Wood.

182. The warnings for all cranberry districts will cover a period of thirty-two hours in advance; if the frosts are expected to continue beyond that period, a new warning will be telegraphed. In preparing the warnings, the time at which the frost is expected

to reach the cranberry-growing districts will be given.

183. As the most successful protection against frost, and the one generally employed by growers, is to cover the marshes with several inches of water and keep the same in motion, and as this precaution involves considerable expense and loss of time during the picking season, it will be necessary to use great caution in making frost predictions for the benefit of this industry.

184. The picking season begins about September 1, and lasts about six weeks. This is a period of great danger, as the least frost ruins the fruit. (6421, Obs., 1885.)

185. Frost warnings for the State of Alabama will be prepared and telegraphed to the

director of the Alabama State weather service, Auburn, Ala. (Mem. 201, 1885.)

186. Special frost warnings will be prepared for Iowa, Minnesota, Dakota, and other extreme Western States and telegraphed to the Observer at Bittehung Po. (Inc. 20

extreme Western States, and telegraphed to the observer at Pittsburg, Pa. (Ins. 22, 1885.)

187. The following form (No. 224 b—1886), showing the present arrangement for the distribution of frost-warning messages, will be used in preparing these messages:

[Form No. 224 b-1886.]

# Frost-warning message.

SIGNAL OFFICE, WAR DEPARTMENT. **–,** 188–. – Washington City, ------

Cranberry districts (May 1 to November 1).—To observers, Boston, Mass.; Philadelphia,

Pa.; Milwaukee, Wis.

Tobacco districts (September 1 to November 1).—Hartford, Conn., to manager Western Union Telegraph Company; New Haven, Conn., to observer; Palmer, Mass., to manager Western Union Telegraph Company; Springfield, Mass., to manager Western Union Telegraph Company; Elmira, N. Y., to manager Western Union Telegraph Company; New York City, to observer; Philadelphia, Pa., to observer; Harrisburg, Pa., to manager Western Union Telegraph Company; ager Western Union Telegraph Company; Harrisburg, Pa., to superintendent telegraph, Reading Railroad Company; Lancaster, Pa., to manager Western Union Telegraph Company; York, Pa., to manager Western Union Telegraph Company; Wilmington, Del., to manager Western Union Telegraph Company; Washington City, to observer; Lynchburg, Va., to observer; Richmond, Va., to manager Western Union Telegraph Company; Richmond, Va., to superintendent Richmond and Danville Railroad; Raleigh, N. C., to manager Western Union Telegraph Company; Cincinnati, Ohio, to observer; Lexington, Ky., to manager Western Union Telegraph Company; Louisville, Ky., to observer; Nashville, Tenn., to observer; Memphis, Tenn., to observer; Hannibal, Mo., to manager Western Union Telegraph Company; Saint Louis, Mo., to observer; Madison, Wis.

Sugar districts (October 1 to April 1).—New Orleans, La., to observer; Galveston,

Tex., to observer; Columbia, Tex.

Fruit and vegetable districts.—Chattanooga, Tenn., to observer (September 15 to May 1); Charleston, S. C., to observer (October 15 to April 15); Georgetown, S. C. (October 1 to April 1); Jacksonville, Fla., to observer (November 15 to April 15).

Tobacco warnings-Special-(September 1 to November 1.) Asheville, N. C. (charges collect); Asheville, N. C. (charges collect); Alabama, Auburn, Ala., via Atlanta; in ex-

treme Western States, notify observer, Pittsburg, Pa.
188. Whenever frosts are expected in the vicinity of any place to which predictions of the weather and temperature are sent, the indications officer will add the frost warning to the dispatch.

# RECORD OF FIRST FROSTS.

189. During the autumn and winter the indications officer will have entered, on a special chart, the first light and killing frosts reported, with the dates of their occurrence.

# FREEZING TEMPERATURES IN CANAL REGIONS.

190. During the period of navigation when freezing temperatures are anticipated in any canal region, special forecasts will be made in the indications and special bulletin.

# COLD WAVES.

191. During his tour of duty, the officer in charge of the indications division will make a study of approaching changes of temperature as indicated in the Northwest, Montana, Manitoba, and Dakota, and adjacent sections, with a view of determining rules of value in predicting cold waves. A careful study of the charts on file for past years will probably indicate practical rules of great value. Each indication officer will read and carefully study Signal Service Notes No. 22. In connection with the foregoing he will include a special study of atmospheric changes which precede frosts. (Ins. 100, 1884; Mem. 78, 1884.)

192. Whenever a cold wave is expected to occur at any of the stations named below, the officer in charge of the indications division will telegraph the observer in the following form: "Hoist cold-wave signal; temperature will probably fall ---- degrees during

- hours."

193. Cold-wave signals will not be ordered unless a temperature of 45° or less is ex-When the temperature is expected to fall 20° or more in any district and not reach 45° the officer in charge of the indications division will announce "a cool wave approaching." The announcements will be made in the "Special Bulletin" and "Indications." No signals will be displayed for cool waves. (L. R. 4071, Sig., 1885; Ins. 27, 1885.)

194. Cold-wave signals will be verified by a fall of fifteen degrees (15°) or more after eliminating the diurnal change of temperature. (714 and 2280, Sig., 1886; Ins. 14, 1886.) 195. When the temperature has reached the minimum the cold-wave signal will be ordered down by telegraph, thus: "Cold-wave signal down." (Ins. 105, 1884.)

196. A display board showing where cold-wave signals are up will be kept in the in-

dications division. (L. R. 6679, Mis., 1984.)
197. Cold-wave signal orders will be entered in the cold-wave signal-order book, and will be checked in the book, and with the display board by the indications officer, after which they will be sent to the telegraph room. (L. R. 6679, Mis., 1884.)

198. Cold-wave signal orders for Wellington, Kans., will be sent from this office

To observer-

199. The following stations cannot be reached by telegraph at midnight: Abilene, Tex.; Auburn, Ala.; Concordia, Kans.; Dodge City, Kans.; Greencastle, Ind.; Lamar,

200. Cold-wave signal orders for Washington City will be filed in the telegraph divis-

ion and with the observer, who will notify the several newspapers.

201. The following form (Form No. 224d), showing the present arrangement for the distribution of cold-wave signal orders, will be used in preparing these orders:

# [Form No. 224 d-1885.]

Whenever a cold wave is expected to occur at any of the stations named in this blank the officer in charge of the indications division will telegraph the observer in the following form: "Hoist cold-wave signal; temperature will probably fall—degrees during the next—hours." When the temperature has reached the minimum the signal will be ordered down by telegraph, thus: "Cold-wave signals down."

# Cold-wave signal message.

SIGNAL OFFICE, WAR DEPARTMENT, Washington City, --, 188—, — m.

o observer—
Cheyenne, Wyo.
North Platte, Nebr.
Valentine, Nebr.
Vankton, Dak.
Denver, Colo.
Dodge City, Kans.
Omaha, Nebr.
Concordia, Kans.
Wellington, Kans.
Leuvenworth, Kans.
Kanses City. Mo. Kansas City, Mo., to dispatcher, Fort Scott and Gulf Railway. Lamar, Mo.
La Crosse, Wis.
Saint Paul, Minn.
Madison, Wis.
Dubuque, Iowa. Dubuque, Iowa.
Des Moines, Iowa.
Davenport, Iowa.
Keokuk, Iowa.
Springfield, Ill.
Saint Louis, Mo. (repeating to Missouri State weather service for interior of State). Cairo, Ill.

Milwaukee, Wis. Chicago, Ill. Grand Haven, Mich. Logansport, Ind. Greenoastle, Ind. Indianapolis, Ind. Greenoastle, Ind.
Indianapolis, Ind.
Louisville, K.y.
Cincinnati, Ohio.
Columbus, Ohio.
Pittsburg, Ps.
Memphis, Tenn.
Nashville, Tenn.
Chattanoogs, Tenn.
Knoxville, Tenn.
Detroit, Mich.
Toledo, Ohio.
Sandusky, Ohio.
Cleveland, Ohio.
Erie, Ps.
Buffalo, N. Y.
Rochester, N. Y.
Oswego, N. Y.
Albany, N. Y.
New York City.
Philadelphia, Ps.
Baltimore, Md.
Washington City. Washington City.

Lynchburg, Va., Richmond, Va., Chamber of Commerce.
Norfolk, Va., Portland, Me.
Boston, Mass. Boston, Mass.
New London, Conn.
New Haven, Conn.
Fort Smith, Ark.
Little Rock, Ark.
Shreveport, La.
Galveston, Tex.
Abilene, Tex.
Palestine, Tex.
New Orleans, La.
Vicksburg, Miss.
Montgomery, Ala. Vicksburg, Miss.
Montgomery, Ala.
Auburn, Ala.
Atlanta, Ga.
Mobile, Ala.
Charlotte, N. C.
Augusta, Ga.
Wilmington, N. C.
Charleston, S. C.
Savannah, Ga.
Jacksonville, Fla.
Sanford, Fla.

HOIST COLD-WAVE SIGNAL, COLD-WAVE SIGNAL DOWN.

#### SPECIAL DISTRIBUTION OF COLD-WAVE WARNINGS.

202. Notifications in regard to cold waves will be sent to the addresses on the list furnished to the indications division.

203. Whenever cold waves are expected in the vicinity of any place to which predictions of the weather and temperature are sent, the indications officer will add the coldwave warning to the dispatch; but notifications to lower cold-wave signals in these cases will not be sent. (9081, Sig., 1885; Ins. 73, 1885.)

# THE INDICATIONS BOARD.

204. The indications board will be permanently organized, and will be composed of the officers stationed in Washington City who have been announced in orders as "Assistants." A majority of the officers present for duty shall constitute a quorum for the transaction of business.

205. One officer of the indications board will be detailed to verify the official indications and signal orders of all kinds. One officer of the indications board will be assigned in charge of the indications division. This detail will not continue more than one

month

206. During the month previous to his assignment to indications division the officer will study all the charts of past years for the month during which he is to be on duty, and during that time he will prepare and furnish for publication in the "Monthly Weather Review" a brief paper containing the results of his study, not to occupy more than one page of the Review.

207. The members present will assemble at 10 o'clock a. m., daily, in the indications

room, to study and discuss current meteorological conditions.

208. The senior officer present will preside at the meetings of the board; the junior officer present will act as recorder of the board. The officer in charge of the indications division will be responsible for all indications, signal orders, and special bulletins during his tour, availing himself of the advice of the board when he so desires.

209. It is the duty of any member of the board to notify the officer in charge of the indications division of any weather indications which he thinks may have escaped attention.

210. All indications and reports from the indications board, including the record of its daily meetings, will be signed by the president and recorder.

211. The proceedings of the board, at its daily meetings, will be placed before the Chief Signal Officer before 12 o'clock noon, each day.

212. The officer in charge of verifications will determine the percentage of verification of indications and the percentage of signals justified, in accordance with the following instructions:

213. The indications will apply to the States or Territories, or parts of States or Territories named, and the percentage of verifications will be determined for each State or Territory, or parts of State or Territory, named in the prediction.

214. Predictions will be made for the following States and Territories which will be named in indications in the order given, and they will be verified by stations as indi-

cated below:

Maine: to be verified by Eastport and Portland, Me.

New Hampshire: to be verified by Boston, Mass., and Portland, Me.

Vermont: to be verified by Albany, N. Y.

Massachusetts: to be verified by Albany, N. Y., and Boston, Mass. Connecticut: to be verified by New London, Conn., and New York City.

Rhode Island: to be verified by New London, Conn., and Block Island, R. I.

Eastern New York: to be verified by Albany and New York City.

Eastern Pennsylvania: to be verified by Philadelphia, Pa

New Jersey: to be verified by New York City, Atlantic City, New Jersey, and Philadelphia, Pa.

Delaware: to be verified by Philadelphia, Pa., and Chincoteague, Va. Maryland: to be verified by Baltimore, Md., Washington City, and Chincoteague, Va. District of Columbia: to be verified by Washington City.

Virginia: to be verified by Washington City, Lynchburg, Norfolk, and Chincoteague,

North Carolina: to be verified by Charlotte, Hatteras, Kitty Hawk, Wilmington, and

Macon, N. C. South Carolina: to be verified by Charleston, S. C., Augusta, and Savannah, Ga.

Georgia: to be verified by Atlanta, Augusta, and Savannah, Ga., Montgomery, Ala., and Jacksonville, Fla.

Eastern Florida: to be verified by Jacksonville and Cedar Keys, Fla.

Western Florida: to be verified by Pensacola, Fla.

Alabama: to be verified by Chattanooga, Tenn., Montgomery and Mobile, Ala. Mississippi: to be verified by Vicksburg, Miss., Memphis, Tenn., New Orleans, and Mobile, Ala.

Louisiana: to be verified by Vicksburg, Miss., Shreveport, and New Orleans, La Texas: to be verified by Galveston, Indianola, Rio Grande City, Brownsville, San Antonio, and Palestine, Tex.

Arkansas: to be verified by Fort Smith and Little Rock, Ark., and Memphis, Tenn.

Tennessee: to be verified by Memphis, Nashville, Chattanooga, and Knoxville, Tenn. Kentucky: to be verified by Nashville, Tenn., Cairo, Ill., Louisville, Ky., and Cincinnati, Ohio. West Virginia: to be verified by Pittsburg, Pa.

Western Pennsylvania: to be verified by Pittsburg and Erie, Pa.

Western New York: to be verified by Erie, Pa., Buffalo, Rochester, and Oswego, N. Y. Ohio: to be verified by Cincinnati, Columbus, Cleveland, Toledo, and Sandusky, Ohio, and Pittsburg, Pa.

Indiana: to be verified by Chicago, Ill., Indianapolis, Ind., and Louisville, Ky.

Illinois: to be verified by Chicago, Springfield, and Cairo, Ill., Davenport and Keokuk. Iowa, and Saint Louis, Mo.

Eastern Michigan: to be verified by Grand Haven, Alpena, Mackinaw City. Port

Huron, and Detroit, Mich.

Western Michigan: to be verified by Duluth, Minn., Escanaba and Marquette, Mich. Wisconsin: to be verified by Saint Paul, Minn., Escanaba, Mich., La Crosse and Milwaukee, Wis.

Minnesota: to be verified by Moorhead, Saint Paul, Saint Vincent, and Duluth.

Minn., and La Crosse, Wis.
Iowa: to be verified by Des Moines, Davenport, and Keokuk, Iowa, Omaha, Nebr., La Crosse, Wis., and Yankton, Dak.

Missouri: to be verified by Saint Louis and Lamar, Mo., Cairo, Ill., Leavenworth,

Kans., and Keokuk, Iowa.

Nebraska: to be verified by Omaha, Valentine, and North Platte, Nebr., and Yankton, Dak.

Kansas: to be verified by Dodge City, Concordia, and Leavenworth, Kans., and Lamar.

Mo. Colorado: to be verified by Cheyenne, Wyo., Denver, West Las Animas, and Montrose, Colo.

Eastern Dakota: to be verified by Huron, Yankton, and Bismarck, Dak.

Indications for the Pacific coast will be prepared for-

Washington Territory, and will be verified by stations located within said Territory. Oregon: to be verified by stations in Oregon.

Northern California: to be verified by stations north of the latitude of 36°.

Southern California: to be verified by stations located south of the latitude of 36°.

(Ins. 27, 1886.)

215. In determining the percentages of verification of predictions, the conditions occurring during the twenty-four hours predicted for, as shown by the charts for the 2d, 3d, and 4th reports following the report on which the prediction was made, will be carefully examined by the verifying officer, who will ascertain whether the conditions predicted for each State or Territory, or part of State or Territory, have prevailed in it to the amount of one-fourth, one-half, three-fourths, or the entire area under consideration. The area for which the prediction is made will be considered in verifying weather and temperature; any fraction of area less than one-quarter will be rated 1; over one-quarter and less than one-half, 2; over one-half and less than three-quarters, 3; and over threequarters, 4. The barometer indications will not be verified, as the prediction is left optional with the indications officer.

216. In determining the percentage of verification of predictions of wind-direction the verifying officer will note the directions reported on the three charts to which the prediction applies, and will ascertain whether the directions observed fulfill the prediction, as follows: If the direction predicted is observed at one-quarter of the observations reported from the stations on the three charts under consideration the percentage of verification will be rated 1; over one-quarter and less than one-half, 2; over one-half and less than three-quarters, 3, and over three-quarters, 4.

217. In determining the total monthly percentages of verifications for all the predictions, the percentage of verification for each State for weather will be multiplied by five; for temperature, by four, and for wind-direction, by one; and the sum of all these

218. In applying the foregoing rules, a prediction of fair weather will be construed to indicate an absence of appreciable rainfall. If precipitation is predicted and one hundredth of an inch, or more, is reported on any one of the three charts considered in the verification, the prediction will be completely verified for the portion of the area covered by the rainfall reported. If no precipitation is reported on any of the three charts considered in the verification, the prediction will be rated a failure. Inappreciable rainfall

will not be counted as precipitation

will be divided by ten.

"Fair weather, followed by rain," or "rain, followed by fair weather," may be predicted, and in such cases, the percentage of verifications will be determined, as indicated in the following table:

First chart.	Second chart.	Third chart.	Sum for prediction of fair weather followed by rain.	Sum for prediction of rain followed by fair weather.
Fair. Fair. Fair. Rain. Rain. Rain. Fair.	Fair. Rain. Fair. Fair. Rain. Fair. Rain. Fair. Rain.	Fair. Fair. Rain. Fair. Fair. Rain. Rain.	2 2 4 0 0 2 2 4	2 2 0 4 4 2 2 0

219. Precipitation may be indicated by the use of the following terms: "Light rain," "light showers," "light snow," "local rains" or "local snows," "showers," "rain," "general rain," "heavy rain," "heavy rain or snow," "heavy snows."

"general rain," "heavy rain," "heavy rain or snow," "heavy snowers," "rain,"
"general rain," "heavy rain," "heavy rain or snow," "heavy snows."

220. Lower temperature, or colder, will indicate that the temperature will be lower at the expiration of the twenty-four hours for which the prediction was made than at the commencement of that period. The prediction will be completely verified if the temperature falls one degree or more over the area under consideration.

221. Higher temperature, or warmer, will indicate that the temperature will be higher at the expiration of the twenty-four hours for which the prediction was made than at the commencement of that period. The prediction will be completely verified if the temperature rises one degree or more over the area under consideration.

222. Predictions may be made for "lower, followed by higher, temperature," or for

222. Predictions may be made for "lower, followed by higher, temperature," or for "higher, followed by lower, temperature," and in such cases the percentages of verifications will be determined as indicated in the following table:

First chart.	Second chart.	Third chart.	Sum for prediction of lower followed by higher temperature.	Sum for prediction of higher followed by lower temperature.
Riso.	Rise.	Rise.	2	2
Rise.	Rise.	Fall.	Ō	4
Rise.	Fall.	Rise.	0 2	2
Rise.	Fall.	Fall.	0	4
Rise.	Rise.	0 change.	0 2 2 0	2 4 2 2 2
Rise.	0 change.	Rise.	2	2
Rise.	0 change.	0 change.	0	2
Rise.	0 change.	Fall.	Q	
Rise.	Fall.	0 change.	0 2 2 4	4
Fall.	Fall.	Fall.	2	3
Fall.	Fall.	Rise.		V
Fall.	Rise.	Fall.	2 4 2 2 2	á
Fall.	Rise.	Rise.	4	Š
Fall.	Fall.	0 change.	2	2
Fall.	0 change.	Fall.	2	ñ
Fall.	0 change.	0 change.	2	ň
Fall.	0 change.	Rise.	3	ž
Fall.	Rise.	0 change.	ð	l ō
0 change. 0 change.	0 change. 0 change.	0 change. Rise.	2	l õ
0 change.	0 change.	Fall.	ة ا	2
0 change.	Fall.	0 change.	ž	2
0 change.	Rise.	0 change.	2	2
0 change.	Fall.	Fall.	0 2 2 2 2 2	4 2 0 2 2 2 2 0 0 2 2 2 2 2 2 4 4
0 change.	Rise.	Rise.	2	2
0 change.	Rise.	Fall.	0	1 6
0 change.	Fall.	Rise.	4	1 0

STATIONARY TEMPERATURE.

223. The prediction for stationary temperature is completely verified if the change at the close of the twenty-four hours is not more than 5°.

#### WINDS.

The prediction for winds will be made, and the percentage of verifications determined. as follows:

224. The quadrant from which the wind is expected to blow must be named, and no prediction, except for variable winds or when the prediction is divided, will apply to more than 90°.

225. In the verification of predictions of wind-directions calms will not be considered, except in the case of variable winds, in which case they verify the prediction.

226. The prediction of north winds will include northwest, north, and northeast winds; the prediction of northeast winds will include north, northeast, and east winds; the prediction of east winds will include northeast, east, and southeast, and so on for the other quadrants.

227. When the prediction is made—"winds shifting to southerly," "winds changing to southerly," "winds becoming southerly," or other direction, the prediction will be completely verified if the last chart shows the direction named. If only the second chart shows the direction named, the prediction will be rated 2, and if only the first chart shows this direction it will be counted 1. If only the first and second charts show this direction it will be rated 3.

228. A variable wind for a single station is one which shifts more than ninety degrees during the twenty-four hours for which the prediction is made. When two or more stations are embraced in the prediction, the directions at the stations must differ from each other more than ninety degrees.

#### VERIFICATIONS OF STORM WARNINGS.

229. The statement showing percentage of signals justified will also show the number of storms for which signals were not ordered. The percentage will be computed sepa-

rately for each class of signals.

230. An on-shore signal will be considered justified when the wind at the station is in an on-shore direction, with a velocity of 20 miles, or more, per hour. They will not be justified as to velocity unless the verifying velocity occurs with the wind in an onshore direction.

231. If, during the display of an on-shore signal, the velocity of the wind at the station equals the verifying velocity for cautionary signals for that station, it will be counted as a storm for which cautionary signals should have been ordered, although the on-shore signal will be considered justified (if the direction of wind is on-shore)

232. The percentage of cautionary and cautionary-direction signals will be computed,

the latter for each quadrant, and both as to direction and velocity.

233. A cautionary-direction signal may be justified as to velocity and not justified as to direction, but a direction signal cannot be justified as to direction unless the wind reaches the verifying velocity in the quadrant named.

234. Cautionary signals are verified as to velocity only.

235. When the wind reaches the verifying velocity at any station within 100 miles of a station at which cautionary or cautionary-direction signals are displayed the signal will be considered justified as to velocity.

236. Observers at coast stations will telegraph, with the next regular report, the maximum velocity and its direction when the wind reaches or exceeds the verifying velocity.

237. Observers at lake stations will telegraph, at the next regular report, the maximum velocity, with the direction, when the wind reaches or exceeds 20 miles per hour.

238. Cautionary signals ordered for Baltimore, Md., will be considered justified if the wind reaches the verifying velocity at any station on the Delaware, Maryland, or Virginia coasts. (6492, Sig., 1886.)

239. The several lists for the distribution of storm-signal orders, cold-wave signal orders, frost warnings for tobacco and cranberry districts, &c., will be revised to date, and kept posted up in the indications division; and will be corrected from time to time on the memorandum order of the Chief Signal Officer, issued by the officer in charge of the correspondence and records division.

#### ADDENDA.

Insert after paragraph 55:

55a. On Chart 2 enter outside and near the circles for each station the current departure, which is the difference between the current barometer and normal barometer for month and hour of report, as shown on the auxiliary charts. This departure is denoted by the sign + if the current barometer be higher than the normal, and by the sign — if less.

556. A carbon line of double weight will be drawn between the + and — departures through points where the barometer is normal, with the sign + and — each on its appropriate side.

Insert after paragraph 62:

62a. On Chart 3 enter at the right of the station the current departure, i. e., the difference between the current actual temperature and the normal temperature for the month and hour of report, as shown on the auxiliary charts. This departure will be preceded by the sign + if the current actual temperature be higher than the normal, and by the sign — if lower.

62b. A carbon line of double weight will be drawn between the + and — departures through points where the temperature is normal, with the signs + and — each on its

appropriate side.

W. B. HAZEN,

Brig. and Bvt. Maj.-Gen'l, Chief Signal Officer, U. S. Army.

Official:

J. MITCHELL, Second Liculenant, Signal Corps, U. S. Army.

5 BIG

#### APPENDIX 3.

ANNUAL REPORT OF OFFICER IN CHARGE OF DIVISION OF LOCAL AND STATE WEATHER SERVICES CO-OPERATING WITH THE SIGNAL SERVICE.

OFFICE CHIEF SIGNAL OFFICER, Washington City, June 30, 1886.

SIR: I have the honor to submit herewith my report of the operations of State weather services co-operating with the Signal Service during the year ending June 30, 1886.

These services have met with encouraging success in a number of the States, and the general interest taken in the subject of these local organizations leads me to believe that there will be a substantial increase in the number of these services during the ensuing year. The object of these services has been fully realized, and they now form important features of the general weather service for the distribution of weather forecasts, frost, cold-wave, and storm warnings, in many sections of the country, especially agricultural regions, where it would be impossible for this service to otherwise furnish these warnings. Many of these services receive daily indications by telegraph from this office, and they are distributed over the State without expense, and for this distribution

this service is indebted to the co-operation of many lines of railroad.

The number of stations at which meteorological observations are taken has largely increased, and the data thus collected are utilized in the preparation of the State bulletins, and also in the preparation of the Monthly Weather Review of this service. State services are now in operation in nineteen States, and are partially organized in eight States. It is to be regretted that this service has not a fund from which instruments could be purchased for the use of State observers, as it is frequently impossible to secure stations at important points owing to the inability of the observers to supply instruments. This service should also be able to provide flags to indicate the character of weather and symbols for the display on railroads when co-operation may be secured. these organizations have undertaken special studies of climatology and meteorology based upon the data collected, and the results of such studies are a practical value to the Signal Service, the stations of which are so limited in number and so widely separated that they only serve to present the general weather conditions existing over the United These services are of especial value to the people of the States where they are in operation. The cost of maintaining them is insignificant when compared with the resulting benefits, and it is only through such organizations that the farmers of this country will beable to utilize the worth of the Signal Service. Millions of dollars may be saved annually in agricultural sections by wide distribution of the weather forecasts, and there are instances of record where a single dispatch conveyed warnings which enabled individuals to save crops of tobacco, sugar-cane, and cranberries valued at hundreds of thousands of dollars. There was an instance which came under my personal observation (I wrote the dispatch myself) where this service gave timely frost warnings to a tobacco region, and for want of an organization similar to these State services that dispatch remained in the center of the tobacco region in the drawer of the telegraph operator, and thirty-six hours after its receipt the whole crop of tobacco was lost by frost, when it might have been saved by cutting.

The great problem of the Signal Service is to devise means for the distribution of the information which is daily collected at the central office. Year after year the predictions are issued from the central office indicating higher or lower temperature for the succeeding day. No distinction was made to indicate the difference between a slight fall in temperature and a cold wave until December, 1883, when a cold-wave signal and its advantages were recommended in my letter to you from Chicago. The advantages following the adoption of this signal have rendered it one of the most important features of the Signal Service. The State services will add still more to the usefulness of this signal by giving its warning to people more distant from the centers of population. In the wheat-growing region of the country the State services will be able to supply weekly and monthly reports of temperature and rainfall, which will prove of great

value to the growth of the crop.

With a view of securing uniformity in the methods of conducting these services a convention of the chiefs of State weather services was held in this city February 24 and 25 of the current year, which was well attended and resulted in improvements which are now being carried out. A general summary of the proceedings of this convention accompanies this report. As it is proposed to increase the efficiency of the State weather services by the detail of a Signal Service observer as assistant to the chief of each service, and as a number of new services are now in process of organization, it is recom-

mended that a second convention similar to that above referred to be held in this city some time during the month of February, 1887.

Referring to the early history of State weather services and their connection with the Signal Service, I respectfully submit the following extract from my letter to the Chief Signal Officer of the Army, dated January 27, 1881, upon which was based your first official action in regard to these services:

(1.) "Secure the favorable action of the legislatures of the several States, requiring each county recorder to take observations of temperature, maximum and minimum, rainfall and wind, at stated hours, the same to be furnished to the Chief Signal Officer on postal cards printed at this office. This would not only enable this office to study the climatology of the whole country, but at the end of ten years would enable it to make very complete charts of rainfall and temperature for every section. This would not only increase the usefulness of the service, as these reports could be collected weekly, but an auxiliary service could be organized in each State, under the direction of this office, which would tend to increase the importance of the Signal Service in every section of the country."

The following are detailed reports of the several chiefs of State services for the year ending June 30, 1886.

I am, very respectfully, your obedient servant,
H. H. C. DUNWOODY,

H. H. C. DUNWOODY,
First Lieutenant, Fourth Artillery,
Acting Signal Officer and Assistant.

The Chief Signal Officer of the Army,

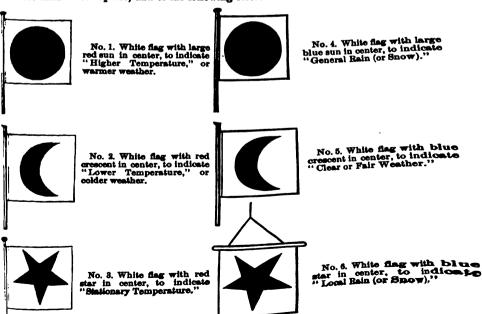
Washington, D. C.

[Circular.]

SIGNAL OFFICE, WAR DEPARTMENT, Washington City, November 1, 1885.

#### WEATHER AND TEMPERATURE SIGNALS.

Upon the urgent demand of those interested in weather and temperature changes, the Chief Signal Officer of the Army has furnished, when possible, the "Indications," at 1 a.m. daily, of the temperature and weather for the ensuing thirty-two hours to many milroads, postmasters, and others in such form that they could be readily converted into signals. Insufficiency of appropriations has, however, greatly crippled efforts in this direction, and has prevented this office from furnishing the necessary signal flags to indicate probable weather conditions. The flags for this purpose should be six in number, not less than 6 feet square, and of the following colors:



In displaying weather and temperature signals only two flags should be hoisted at one time. If more than one kind of weather or temperature is predicted, the last-named kind will decide which flag to hoist.

The position of the flags in any hoist will have no significance, as each flag designates a specific condition of weather or temperature in whatever position it may be placed.

During a calm, or when the wind is light, the signals cannot be readily distinguished; and if flags are hung as shown by the blue star signal on the above cut, it will be found to be satisfactory for any velocity of the wind.

There being no funds at the disposition of the Chief Signal Officer for the nurchase of

There being no funds at the disposition of the Chief Signal Officer for the purchase of the flags, if they are desired and cannot be secured in the vicinity, the set of six may be obtained for—

Thirteen dollars from M. G. Copeland & Co., No. 634 Louisiana avenue, Washington,

D. C. (standard bunting);

\$15 from Crane & Co., McWhorter & Oliver streets, Newark, N. J.;

\$15 from C. S. Decker, No. 168 State street, Boston, Mass.;

\$15 from Horstman Bros. & Co., Fifth and Cherry streets, Philadelphia, Pa. ("Eagle" bunting);

\$15 from John F. McHugh, No. 1286 Broadway, New York City.

Correspondence in relation to these flags should be had direct with the above firms and

not through this office.

As the weather indications are telegraphed daily to a large number of the stations of the Signal Service, to railroads, post-offices, &c., there are very many small towns which could, by proper arrangement, obtain them by telephone or otherwise from the Signal Service stations, railroad stations, or post-offices receiving the reports and displaying the flags. Places not reached through any of these mediums desiring to display the signals should correspond with the Chief Signal Officer in reference to the subject, when, if possible, action will be taken to furnish the indications as soon as the necessary flags have been obtained and arrangements made for their display.

The system here outlined and now in successful operation at various places could, by a little exertion and a small outlay for flags on the part of those who would be benefited by the signals, be extended indefinitely and become one of the most valuable aids to the farmer, the merchant, and the public generally. This system has been adopted and is used by some of the principal railroads throughout the country, disks made of steel or iron being displayed from the baggage cars. These roads transmit over their wires each morning to the points from which trains start the kind of symbols to be displayed, the baggage masters at those points attending to the changing of them.

Many large firms and corporations are displaying these signals, introducing them (and at the same time advertising their business) by printing the signals and their meaning

on the back of their business cards.

Communications in reference to the display of signals and symbols should be addressed to—

W. B. HAZEN, Brig. and But. Maj. Gen'l, Chief Signal Officer, U. S. A.

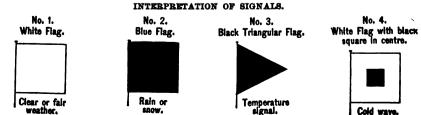
[Circular.]

SIGNAL OFFICE, WAR DEPARTMENT,

Washington City, November 10, 1886.

Weather signals adopted for general use by the Signal Service on and after March 1, 1837. With a view of securing a uniform system of signals it is recommended that flags now in use be replaced by those herein described as the former become worn out or unserviceable.

The Chief Signal Officer furnishes, when practicable, for the benefit of the general public and those industries dependent to a great extent upon weather conditions, the "Indications," which are prepared at this office daily, at 1 a. m., for the twenty-four hours commencing at 7 a. m. These weather forecasts are telegraphed to many Signal Service stations, railway officials, and others, and are so worded as to be readily communicated to the public by means of flags or symbols. The flags adopted for this purpose are four in number and of the form and dimensions indicated below:

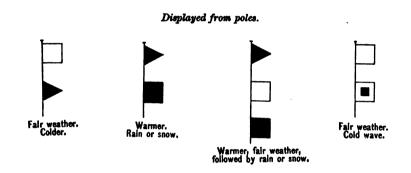


No. 1, white flag, 6 feet square, always indicates clear or fair weather, no rain. No. 2, blue flag, 6 feet square, indicates rain or snow. No. 3, black triangular flag, 6 feet at the base and 6 feet in length, always refers to temperature. When placed above Nos. 1 or 2 it indicates warmer weather; when placed below Nos. 1 or 2 it indicates colder weather; when not displayed, the indications are that the temperature will remain stationary, or that the change in temperature will not vary 5 degrees from the temperature of the same hour of the preceding day. No. 4, cold-wave flag, 6 feet square, indicates the approach of a sudden and decided fall in temperature. This signal is usually ordered at least twenty-four hours in advance of the cold wave. It is not displayed unless a temperature of 45 degrees, or less, is expected, nor is flag No. 3 displayed with it.

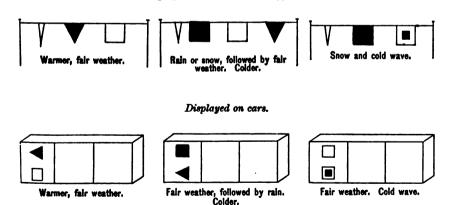
When displayed on flag-poles the signals should be arranged to read downward; when displayed from horizontal supports a small streamer should be attached to indicate the point from which the signals are to be read; when in the form of symbols, to be displayed on cars, the symbols should be placed one above the other and read downward.

The signals may be withdrawn at 3 p. m.

#### EXAMPLES.



#### Displayed from horizontal supports.



When the two weather symbols cannot be displayed show the one indicating the weather last named in "Indications."

As the weather indications are telegraphed daily to a large number of stations of the Signal Service, to railroads, &c., in various sections of the country, there are many small towns where they may be obtained by telephone, free of expense. Those desiring to

display weather signals and not able to obtain the indications as above, should communicate direct with the Chief Signal Officer, and if it is not practicable to telegraph the indications, at the expense of the United States, to such places, they will always be fur-

nished at Government rates, at twenty cents per message, sent collect.

Weather signals are now displayed at many stations throughout the United States, and this improved system, which is based on that devised by Prof. P. H. Mell, Jr., of Alabama, has been adopted with a view of securing uniformity, and is recommended, after a careful test of the several systems now in use, and submitted for examination. The system is not complicated, the solid colors will secure legibility, and the flags may be supplied at small expense.

There being no funds at the disposition of the Chief Signal Officer for the purchase of flags, if they are desired and cannot be procured in the vicinity, they may be purchased

from any of the following firms, at prices ranging from \$6 to \$12 per set:

M. G. Copeland & Co., No. 634 Louisiana avenue, Washington, D. C. (standard bunting).

Crane & Co., McWhorter and Oliver streets, Newark, N. J.

C. S. Decker & Co., No. 168 State street, Boston, Mass.

Horstman Bros. & Co., Fifth and Cherry streets, Philadelphia, Pa. ("Eagle" bunting).

John F. McHugh, No. 1286 Broadway, New York City.
S. Hemmingway, No. 60 South street, New York City.
P. H. Mell, Jr., Auburn, Ala.
Correspondence in relation to these flags should be had direct with the above firms. and not through this office. The flags may be made of cotton cloth at an expense not to exceed \$2 per set. The displays here outlined may be greatly extended and become one of the most valuable aids to farmers, shippers, and the public generally by a little exertion and a small expense for flags on the part of those who would be benefited by the signals. Weather signals have been adopted and are in use by some of the principal railroads throughout the country, the symbols, made of tin or sheet iron, being displayed from the baggage car. These roads transmit over their wires each morning to points from which trains start the names of the symbols to be displayed, the baggagemasters at those points attending to the signals. Many large firms and corporations are displaying these signals and at the same time advertising their business by printing the signals and their meanings on the back of their business cards.

Communications in reference to the display of signals and symbols should be addressed

to

W. B. HAZEN, Brig. and Bot. Maj. Gen'l, Chief Signal Officer, U. S. Army.

#### ALABAMA.

#### POLYTECHNIC INSTITUTE AND AGRICULTURAL AND MECHANICAL COLLEGE,

Auburn, Ala., June 9, 1886.

SIE: In a letter just received from Lieutenant Dunwoody I am requested to furnish you with a brief account of the operations of the State service during the year. &c.

The service has now thirty-seven observers that are doing valuable work, and consisting of some of the most prominent men in the State.

A large amount of valuable data has been accumulated at the central office that will

be of great service hereafter in determining the climate of the State.

The monthly bulletins have been issued regularly, with special bulletin occasionally, on subjects of special interest to the farmers of the State.

The distribution of the weather and temperature predictions has been attended to regularly each day. No new roads, however, have been added to the system since January, 1886, because your orders to me were to discontinue such work until further orders. roads and corporations now receiving these daily warnings are as follows: South and North Railroad; Montgomery and Mobile Railroad; Mobile and Girard Railroad; Georgia Pacific Railroad; East Tennessee, Virginia and Georgia Railroad, extending through Georgia; East Tennessee, Virginia and Georgia Railroad, extending through Alabama; Memphis and Charleston Railroad; Columbus and Western Railroad; Atlanta and West Point Railroad (the stations on this road catch the telegram as it is transmitted from Washington); Northwestern Railroad of Georgia; Western and Atlantic Railroad of Georgia; Montgomery and Eufaula Railroad; Pensacola and Selma Railroad; Pensacola and Atlantic Railroad; the cities of Milledgeville, Ga., and Talladega, Ala. Those railroads entering Atlanta, Ga., receive the warnings from the observer at that point. The Georgia Railroad and the Central Railroad of Georgia were also parts of my system, as well as the Savannah, Florida and Western Railroad, but in accordance with your orders they were turned over to the observers at Augusta and Savannah, Ga.

In the matter of this signaling system there have been many difficulties with which to contend, and some of them have been insurmountable, the chief of which has been the irregular transmission on the part of the Western Union Telegraph Company. Although Although I had so many stations at the close of last year throughout this State and Georgia, to-

day I have not one-half the number in operation.

The people very readily bought the flags and had them raised, but the telegrams were received by them so irregularly that they became discouraged and lost interest in the prediction and very soon ceased to raise the signals. Every effort on my part to counteract this effect has proved a failure, because I could not guarantee the prompt attention on the part of the Western Union. For instance, in the transmission of the telegrams from Auburn to Birmingham the messages would be delayed both at Montgomery and Birmingham, and frequently it would be in the afternoon before the railroad authorities would receive my instructions. Unless the warnings are put in the railroad office before 8 a. m. the business of the road will retard the distribution very materially. It is my intention to visit all stations belonging to my system this summer and try to revive an interest in this important branch of the service; but unless something is done to obviate the difficulty already stated I see but little use in undertaking the work. If you will glance at a map of Alabama and Georgia you will see that the railroads now belonging to my system cover almost every portion of the country. Without any additional expense, except the purchase of the flags, three hundred and twenty-five towns and villages can be benefited by these predictions, and this is all accomplished by the expense now incurred by the Chief Signal Officer. Much interest is manifested in the service whenever the work is kept up regularly, and many complaints have come to me from all sections clamoring for remedies. I inclose copies of bulletins that will give you items in regard to the service under my charge that will be of use to Lieutenant Dunwoody in his annual report.

Very respectfully submitted.

P. H. MELL, Jr., Director Alabama Weather Scrvice.

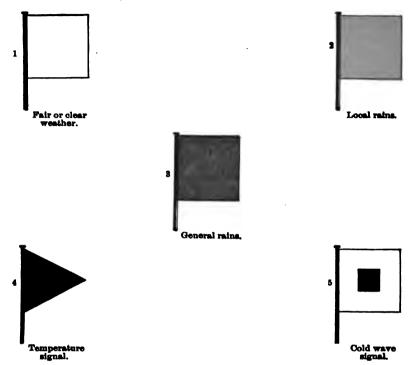
CHIEF SIGNAL OFFICER, Washington, D. C.

List of meteorological stations of the Alabama State weather service.—Auburn, Birmingham, Bermuda, Carrollton, Centre, Chattanooga, Decatur, Evergreen, Eufaula, Fayette, Florence, Gadsden, Grove Hill, Goodwater, Greensboro, Jacksonville, La Fayette, Lineville, Livingston, Marion, Mobile, Montgomery, Newton, Oswichee, Prattville, Roanoke, Russellville, Springville, Selma, University of Alabama, Troy, Tuscumbia, Trinity, Union Springs, Valley Hill, Mount Willing.

#### Alabama weather service.

#### CENTRAL OFFICE, AUBURN.

#### [Weather signals. Preserve for reference.]



#### EXPLANATION OF SIGNALS.

#### PREPARATION OF INDICATIONS.

The weather indications furnished to the State by the Chief Signal Officer are based on observations taken in all parts of the country three times a day. The morning indications are prepared at 1 a. m. (eastern standard time) and hold good till the following morning.

#### DISPLAY OF FLAGS.

In accordance with these indications the proper official flags, illustrated on the reverse side of this card, should be selected and promptly displayed. If elevated on a pole, they should be so arranged as to read downward. If the indications read followed by ______, then a space, the width of a flag, should be left vacant on the pole to indicate "followed by." The signals should be withdrawn at 3 p. m.

#### MEANING OF FLAGS.

No. 1 [white flag] refers always to Fair or Clear Weather. No. 2 [orange flag] refers always to Local Rains. No. 3 [blue flag] refers always to General Rains.

No. 4 [black triangular flag] refers always to Temperature. When placed above either Nos. 1, 2, or 3 indicates Rising Temperature; when placed below these numbers (1, 2, or 3) indicates Falling Temperature; when absent from the pole Stationary Temperature is indicated.

No. 5 [white flag with black square] refers always to decidedly colder weather, and is generally issued twenty-four hours in advance of the expected fall of temperature.

This signal is not ordered unless it is expected that the temperature will fall to forty-five degrees, Fahrenheit, or below, within the time stated in the order.

* No. 6 [orange flag with black square] indicates the approach of a cyclonic wave.

#### EXAMPLES.

"Cooler, fair weather," display flag No. 1 with No. 4 below it.

"General rains, higher temperature," display No. 3 with No. 4 above it.

"Stationary temperature and local rains," display No. 2 only.

"Stationary temperature and general rains, followed by cooler clear weather," display No. 3 (space) and No. 1 with No. 4 below it.

Public notice of these explanations should be secured in local newspapers as generally as possible, and by posting this card near the point of display where it can be examined by the public.

P. H. MELL, JR., Director Alabama Weather Service.

#### NEW ENGLAND METEOROLOGICAL SOCIETY.

CAMBRIDGE, MASS., May 31, 1886.

SIR: In reply to your favor of the 27th instant I have pleasure in making the inclosed statement, by circular and otherwise, of the condition of our society. To this I would add: Membership, about 100; bulletins, 19 published (including June, 1886); volunteer observers of thunder-storms (special investigation in co-operation with the United States Signal Service), about 500, mostly in addition to the 140 regular observers for bulletin; membership increasing; inclosures 4-7; in co-operation with the Appalachian Mountain Club especial attention will be given to the climatology of the White Mountain region; weather signals will be reported shortly.

Very respectfully,

W. M. DAVIS,

Secretary New England Meteorological Society.

Lieut. H. H. C. DUNWOODY, Signal Office, Washington, D. C.

#### [Extract from the annual report of the director, Prof. Winslow Upton.]

During the past year the council has engaged in the following branches of work: 1. The securing of a corps of reliable observers of meteorological phenomena, with special attention to precipitation and temperature; 2. The publication of the monthly bulletin; 3. The dissemination of the daily indications of the United States Signal Service and the local display of weather flags; 4. The special investigation of thunder-storms. The work of securing reliable observations was so far advanced in November, 1884, as to warrant the issue of the first bulletin for that month, and its regular publication thereafter. The first bulletin contained reports from 45 observers; that for September, 1885, from 123 observers. Efforts have been constantly made to secure increased accuracy and greater uniformity in the observations, in order that they may furnish a reliable basis for future investigations. The subject of accurate instruments received early attention. After many experiments it was decided to manufacture a special class of rain-gauges rather than to adopt any now in the market; and to adopt, for self-registering thermometers, those of certain reliable firms. The experience of the year has fully justified this policy. All who were desirous of making observations have been encouraged to do so, prespective of location, but efforts have also been made to secure observers in special localities. This would be an easier task if the society were able to furnish instruments, for the cost of instruments has sometimes prevented those interested from undertaking The bulletin has been prepared on a uniform plan, with a few minor changes suggested in the progress of the work; in addition to the usual summary of the observations, each number has contained a map, prepared by the Secretary, showing the distribution of precipitation and temperature ranges.

The terms "Cyclone" and "Tornado" must not be confused. The first indicates a great storm moving the air particles toward the center of the disturbance in great circuits, the diameter of which is sometimes hundreds of miles in extent. Tornadoes are local disturbances in a cyclone. Sometimes near the center of a great storm, or cyclone, the general inward tendency of the air revolves with such violence as to prostrate houses and trees and carry heavy objects to a great distance—this is a tornado. Its duration at any one place scarcely exceeds more than one minute, and the width of the path is seldom more than 100 yards.

The society has co-operated with the United States Signal Service in the dissemination of the daily indications and local display of weather flags. A member of the Signal Corps, Mr. O. N. Oswell, has been assigned to duty under the society's control; without his assistance this portion of the work would not have been undertaken. The aid thus given has been of great advantage in other departments of work, especially in the clerical labor attending the preparation of the bulletin and the special investigation of thunder-storms.

The Signal Service Observer at New Haven has also successfully labored to secure the display of weather flags in Connecticut in harmony with the society's plans. As a result, local weather flags are displayed in more than one hundred cities and towns of New

England

The special investigation of thunder-storms was made under the supervision of the secretary. The members of the National Academy who constitute the trustees of the Bache fund appropriated \$200 for this work. More than four hundred observers co-operated, the largest number of reports for any single storm having been two hundred and three. The preliminary study of the reports thus far made indicates that some interesting results have been obtained, which will be reported upon subsequently.

The original membership of the society was 9; the number at the close of the year 95. The expenses of the society have been kept within its income, but this has been done through the generous co-operation of friends, who have from time to time contributed

liberally to its resources.

In looking forward to the work of another year the council suggests that special efforts be made to add to the membership of the society as well as to the list of observers. It must be remembered that the financial prosperity of the society depends on the number of members. It is desired to include in the membership all who are interested in meteorological studies in New England, whether they make observations or not. A member need not be an observer, nor is it required that an observer shall be a member. The council expresses the hope that the second year of the society may be as successful as the one just ended, and sincerely thanks all who have contributed to its prosperity.

A monthly bulletin is published by the New England Meteorological Society, to which reference may be made to Tables I, II, III, and IV, for a list of observers, 144 in all, for April, 1886. This membership, with very few exceptions, increases every month since

the publication of the bulletin was begun.

[Circular No. 4.]

### NEW ENGLAND METEOROLOGICAL SOCIETY—PRESENT CONDITION OF THE SOCIETY—GENERAL STATEMENT.

The society was formed in 1884. Its constitution states that "its object shall be the cultivation of meteorological science in New England." Persons interested in this object are therefore invited to apply to the secretary for membership. The annual fee is \$3. Members are entitled to attend and to vote at the meetings of the society and to receive a copy of its publications; members need not make observations, and residence n New England is not required.

The society acts in co-operation with the United States Signal Service, and occupies in New England the same position as that taken by the State weather services in other parts of the country. All voluntary observers of the Signal Service in New England are desired to report to the society. The society encourages the local display of weather signals, based on the daily predictions issued from the Signal Office in Washington. Correspondence concerning these signals in Connecticut should be addressed to the Observer, Signal Office, New Haven, Conn.; in other parts of New England, to the Observer, Signal Office, Boston, Mass.

The fundamental work of the society is the collection of systematic records of climatic elements, such as temperature, rainfall, and the like, made by trustworthy observers with accurate instruments. This work is in charge of the director, and about one hundred and fifty observers are now co-operating in it. Additional observers are desired, especially at points not now represented (see map on other side). Observers need not take membership in the society. The monthly bulletin is sent them without charge.

take membership in the society. The monthly bulletin is sent them without charge. In order to insure accuracy of record, thermometers and rain-gauges belonging to observers regularly reporting to the society will be tested free of cost by Prof. S. W. Holman, of the Massachusetts Institute of Technology, Boston. All instruments bought through the society will hereafter be tested in this way. Correspondence concerning the purchase and testing of instruments should be addressed to the secretary.

A monthly bulletin, prepared by the director, is published by the society, containing a general statement of the weather for the month preceding that of its issue, a summary of observations collected, presented in tabular form, and a map showing graph-

ically the mean diurnal range of the temperature and the total amount of precipitation. The map from the bulletin of March, 1886, is reprinted on the other side of this circular. The bulletin is sent free to members and to regular observers; to others the subscription price is one dollar a year, payable to the treasurer.

The society holds regular meetings on the third Tuesday of October, January, and

April, when communications of scientific interest are presented.

Special investigations may be undertaken from time to time. Those that the society is at present engaged in are the study of thunder-storms, under the direction of the secretary, and the examination of rainfall, temperature, &c., in general storms, by the director.

WM. H. NILES,

Massachusetts Institute of Technology, Boston, Mass., President,
WM. M. DAVIS,

Harvard College, Cambridge, Mass., Secretary,
DESMOND FITZGERALD,
M. Am. Soc. C. E., Brookline, Mass., Treasurer,
E. B. WESTON,
M. Am. Soc. C. E., Providence, R. I.,
WINSLOW UPTON,
Brown University, Providence, R. I., Director,
Council of the Society.

[Observations of thunder-storms in co-operation with the United States Signal Service: Second season—1886.]

Thunder-storms will constitute a subject of special investigation during the summer

months on much the same plan as in 1885.

The phenomena of thunder-storms have been chosen for this study, as offering at once the greatest variety of features easily observed, and promising in return the most interesting results.

Volunteer observers to take part in the study are wanted in all parts of New England.

The desired observations are classified as follows:

Class A.—No instruments required. Simple records of the time of beginning and ending of rain, when thunder is heard first and loudest, and of the direction of wind and its changes.

Class B.—Ordinary instruments needed. A thermometer and a tin can for collecting rain. A somewhat more detailed record of rain, wind, temperature, thunder, &c., during

the passage of a storm.

Class C.—Good instruments needed. Better measures of rain and temperature, with barometer readings if possible; and especially more careful observations on clouds.

This division into classes need not be closely followed. Observers of Class A may add, for example, temperature of Class B, or clouds of Class C, to their subjects of record.

Days when observations are wanted:

(1) Observations are to be taken through June, July, and August whenever a thunder-

storm can be seen or heard.

(2) Observations are also desired at regular intervals from noon to 6 p. m. on certain days, whether a thunder-storm is in progress or not. These days will be called term-days; they will be appointed one and a half to two days in advance by special message from the Chief Signal Officer in Washington, and will be announced to the public by telegraphic reports to all newspapers of the New England Associated Press. They will be days on which thunder-storms are expected.

Instructions, blanks for observations, and stamped envelopes for returning the records to the Boston signal office will be distributed to volunteers in the latter part of May. Correspondents will be answered as promptly as possible, but a brief delay will some-

times be unavoidable.

Volunteers are requested to send in their names as early as possible. The inclosed franked envelopes may be used (without stamp) in returning the card of agreement, list of recommended observers, or other matter connected with this investigation. No one need hesitate to undertake the work from lack of practice, as the instructions give all necessary information, and the simpler class of records ( $\Lambda$ ) can easily be kept by any intelligent boy or girl.

Special circulars addressed to yachtsmen and pilots and to amateur photographers may

be had on application.

The council of the society requests the assistance of all persons interested in this investigation, not only in keeping records themselves, but particularly in extending the number of observers in their neighborhood.

W. M. DAVIS, Secretary New England Meteorological Society, Cambridge, Mass. [Observations of thunder-storms in co-operation with the United States Signal Service.—Second season, 1886.—Circular to New England newspapers.]

The council of the society asks the assistance of the newspapers of New England in making its plan of volunteer observations of thunder-storms known to their readers, and for this purpose requests the publication of extracts from the inclosed circular.

Special investigations of thunder-storms are in progress in a number of European coun-

tries, and have lately been instituted by the United States Signal Service.

In 1885 the New England Meteorological Society undertook a similar study, and received assistance from over three hundred volunteers. It is hoped largely to increase the number of observers this summer.

The desired observations are graded in three classes; the simplest class requires no instrumental observations; a share in the work is therefore within the reach of all intel-

ligent persons who take an interest in the weather.

Term-days.—In order to secure observations in all parts of New England on days when thunder-storms are likely to occur, a special message will be sent from the Signal Office, Washington, announcing these days thirty-six to forty-eight hours in advance, and this message will be repeated from Boston to all newspapers belonging to the New England Associated Press. The days thus selected will be called term-days for observers of the New England Meteorological Society.

You are respectfully requested to aid in making the announcement of term-days public. Be kind enough to inform me of your willingness to do so. A list of the newspapers agreeing to print the term-day dispatches will be sent to all observers about the

middle of May.

W. M. DAVIS,

Secretary New England Meteorological Society.

HARVARD COLLEGE, Cambridge, Mass., April, 1886.

[Observations of thunder-storms in co-operation with the United States Signal Service. Second season, 1886. Announcement of term-days.]

Dispatches from the Signal Office in Washington announcing term-days for hourly observations will be worded about as follows:

Washington, June —, 1886. —, June —, is appointed term-day for the observers

of the New England Meteorological Society.

(As has been explained in earlier circulars, term-days are those on which thunderstorms may be expected in some part of New England. Observations are desired on these days from all volunteers, according to instructions, whether thunder-storms occur or not.)

As soon as t e term-day dispatch is received in Boston it will be sent to the agents of the New England Associated Press and the United Press, and by them distributed to all their corresponding newspapers in New England, about fifty in number, so that very general publication will be gained. The message will generally be printed immediately after the paragraph giving the weather indications.

The following newspapers have expressed their willingness to publish the term-day

dispatches:

Boston, Mass.: Advertiser, Globe, Herald, Journal, Post, Record, Transcript, Traveller. Fitchburg, Mass.: Sentinel. Lowell, Mass.: Citizen, Courier, Mail, Times. Holyoke, Mass.: Transcript. Manchester, N. II.: Mirror, Union. New Bedford, Mass.: Mercury. Newburyport, Mass.: Herald, Germ. Newport, R. I.: News. Pittsfield, Mass.: Journal. Portland, Me.: Argus, Press. Springfield, Mass.: Republican. Worcester, Mass.: Gazette.

It is suggested that observers who do not find their daily paper in the above list should inclose this circular to the editor of the daily paper that they take, and ask if the dispatches here described will be printed in it, so that the announcements will surely

be received.

Observers are reminded of the importance of recording even apparently trivial phenomena, such as the occurrence of a light shower with moderate thunder, or the distant passage of a thunder-storm near the horizon. The true value of these records will appear when they are studied in connection with all others of the same date.

It is desired also to emphasize the importance of accurate record of rain-beginning and of the hourly observations on term-days, and (for classes B and C) the observations on the even hours and half-hours during thunder-storms. Much of the success of the investigation depends on the care of observers in these respects.

W. M. DAVIS,

Secretary New England Meteorological Society.

[Observations of thunder-storms in co-operation with the United States Signal Service.—Second season, 1886.—Special circular to amateur photographers.]

The council of the New England Meteorological Society requests the assistance of experts in photography in securing views of the clouds in approaching and receding thunder-storms during the coming summer. Such photographs, studied in connection with the numerous reports gathered from volunteer observers throughout New England (see accompanying circular), will afford data for the determination of the form and altitude and something of the mechanism of our local storms.

Views are especially desired of the strongly developed storms that arise in the west after a noon of oppressive heat. The plan of work to be followed may thus be stated:

When the bank of storm clouds is visible in the west, and distant thunder is faintly heard, set the camera toward that point of the horizon above which the clouds rise highest. Note its direction carefully by compass, and, letting it remain in this position, take several views of the clouds as the storm approaches; repeat the process, with the camera facing in the opposite direction as the storm moves away. If the storm passes to one side of the observer, take a series of views toward the highest part of its clouds

during its progress, noting the direction of the camera accurately at each exposure.

Record the time at which each view is taken as accurately as possible. The plates used should not be smaller than 5x8 inches, if possible. The views need not be of the highest artistic excellence; it will serve if they show the outlines of the cloud-masses

with some distinctness.

The lens should be in all cases precisely opposite the center of the plate, and the plate should be at right angles to the line of sight, the swing-back not being used; the camera may be directed obliquely upward if necessary, but in this case the angle of elevation of the line of sight must be carefully determined. It would be well always to include the sky-line on the plate, and to determine the elevation of the sky-line above the true borizon. The views should be taken from an elevated point, or from the roof of a house, so as to command as uninterrupted a horizon as possible.

Views of lightning flashes are also desired; they may be obtained by exposing a plate

at night, the camera being directed toward a storm, and waiting till a bright flash appears before covering the lens. Several flashes may be taken on one plate.

In order to determine the scale of the visual angle of the camera take a view of a house at a distance of one or two hundred yards, the line of sight being at right angles to the visible side of the house, the house being in the center of the field, and the distance to the house and the length of its side being carefully measured.

Those who are willing to take part in this investigation are requested to address W. M. DAVIS,

Secretary New England Meteorolgical Society.

HARVARD COLLEGE, Cambridge, Mass.

Boston, Mass., June 7, 1886.

DEAR SIR: In reply to your card of 31st ultimo I would say that we have forty-five stations where the flags are displayed, and every little while I hear of new places not on our list. I think there must be fifty towns at least where they are displayed; besides this I find that the telephone people give the indications to a great many places where they don't display the flags, but bulletin them. This flag system seems to have taken the place of the old farmers' bulletin.

Yours truly.

OTTO B. COLE.

Prof. W. M. DAVIS, Cambridge, Mass.

> NEW ENGLAND METEOROLOGICAL SOCIETY. Cambridge, Mass., June 3, 1886.

DRAB SIR: In regard to weather flags displayed in New England the following statement may be made as a supplement to my recent letters concerning our society work. The display of weather flags was begun early in 1885; they are now hoisted at forty-five stations in Massachusetts, New Hampshire, and Vermont, great aid in the distribution of the weather indications being given without charge by the New England Telephone and Telegraph Company. Sergeant Cole, of the Boston Signal Office, has recently taken charge of the display in these States. In Connecticut the display of these flags was inaugurated by Sergt. J. H. Sherman, New Haven Signal Office, in connection with the New England Meteorological Society; he secured generous assistance from the Standard Time and Electric Company of New Haven, over whose wires the daily messages were sent without cost to towns where flags are hoisted by the operators of this company. I am at present unable to fill in the number of flag stations in Connecticut, Sergeant Sherman not yet having answered my letter of inquiry on this point.

I shall be very glad to see your report.

Very truly yours,

W. M. DAVIS, Secretary.

Lieut. H. H. C. DUNWOODY. Signal Office, Washington.

#### MINNESOTA WEATHER SERVICE.

#### GENERAL STATEMENT.

The Minnesota Weather Service is under the auspices of the Saint Paul Chamber of Commerce, and in co-operation with the United States Signal Service and the Minnespolis and Saint Louis Railway Company.

The central station is located at the Chamber of Commerce building, Saint Paul, with a United States signal officer in charge. The director's office is at Carleton College

Observatory, Northfield.

In consideration of locating the central station of this weather service at its building in Saint Paul, the Chamber of Commerce agrees to furnish such aid, to offer such co-operation and supervision as are necessary for the efficient operation of a general and comprehensive weather service for the entire State. In accordance with these arrangements, already definitely made, the director, with the co-operation as aforesaid, respectfully submits the following plan of organization:

submits the following plan of organization:

Stations.—The local stations of this weather service in the various towns and cities of this State are divided into two classes: (1) Observing Stations and (2) Flag Stations; all of which should be under the supervision of the local board of trade, city council, or

some other suitable local organization, for financial support and oversight.

The local authorities supporting observing stations will be asked to procure a set of meteorological instruments, a set of signal-service flags for daily indications and warnings, a bulletin board for posting weather dispatches and daily local temperatures, and to secure and maintain an observer who will care for the instruments, observe them daily at the hours of 7 a. m., 2 p. m., and 9 p. m., and report on suitable blanks provided for that purpose, the observations once each week on the morning of ————, with any other meteorological phenomena that may have been observed. The local authorities supporting flag stations of this service will be asked to procure a set of signal-service flags, a bulletin board for daily telegraphic indications, and to secure and maintain competent persons to post the daily weather bulletins before 8 o'clock each morning, and to display at the same time appropriate flags for all predictions belonging to this class of stations. The persons in charge of flag stations will be asked to report on appropriate blanks to the central station on Monday of each week whether or not the predictions of each day of the preceding week were verified.

Central Station.—The signal officer in charge of the central station will, in general,

discharge the following duties:

1. Co-operate with the director in completing the organization of the service.

2. Collect, reduce, tabulate, and summarize all meteorological data that may be of public use, and report the same weekly and monthly, as directed by the Chief Signal Officer and the director of the State service. He will also keep a record at the central station for public examination of the monthly averages of temperature, precipitation, and other meteorological data available for each local station of the service.

Except on Sunday, the central station will communicate by telegraph to local stations in the name of the director, the daily weather indications, and also cold wave warn-

ings as soon as practicable after the same have been received from Washington.

4. As soon as possible a system of regular visitation of all local stations will be undertaken by the director, or the signal officer, to verify the character of local observations and test the condition of instruments.

5. Weekly summaries of useful meteorological facts and data will be distributed promptly to the newspapers of the State. A monthly bulletin, setting forth in a concise way the results of each month's observations, will also be published, in common with the practice of similar weather services in other States.

Local stations, to the extent of one in each county, may be organized on application to the central station in writing, signifying a willingness to accept the conditions

and perform the duties of such stations, as indicated in this circular.

Meteorological instruments.—The meteorological instruments needed for local stations can be obtained at reduced cost, if purchased by the director of this State service through the Chief Signal Officer, Washington, D. C. Prices at present are as follows:

Signal Service barometer, vernier reading to 100th inch	\$36	50
Thermometer:	•	
Minimum self-registering	4	60
Maximum self-registering	5	60
Wet bulb, cup, and support	5	10
Dry bulb and support	4	00
Rain gauge (copper overflow)	1	50
Wind vane (sunset)	8	00
Robinson's anemometer	26	05
Gibbon's self-recorder	28	55
Gravity battery (2 cups) and wire	2	50
Bulletin board for telegraphic dispatches (estimated)	5	00
Six flags for weather and temperature signals	15	00
Cold wave flag		50
Total cost	144	

These prices do not cover cost of transportation of instruments from Washington, or the expenses of a signal officer to set up the instruments at local stations. The actual cost of these items only will be charged in addition.

WM. W. PAYNE,
Director Minnesota Weather Service.
THOS. COCHRAN, Jr.,
WM. F. PHELPS,
D. R. NOYES,
Committee of Chamber of Commerce.

Approved.

W. B. HAZEN, Chief Signal Officer.

CARLETON COLLEGE OBSERVATORY, March 20, 1886.

Application for a local station in the Minnesota Weather Service.

The, of, hereby makes application to the director of the Minne
so that weather service that an observing station or a flag station be forthwith located a
; and that the same be equipped with the following meteorological instruments
and apparatus, procured by the said director at the cost specified below:

Instruments.	Number.	Cost.
Signal Service barometer, vernier reading to 100th inch		
Minimum, self-registering Maximum, self-registering Wet bulb, cup, and support Dry bulb and support		
Rain-gange (copper overflow)		
Gravity battery (two cups) and wire		
Str fags for weather and temperature signals		
Total		i

The appoints	- as a suitable person to take charge of this local sta-
tion, and agrees to pay i	ne services contemplated in this application ——— per month. case instruments are broken at this station, or in transit to it,
The also agrees,	ase instruments are broken at this station, or in transit to it,
to bear the loss and ret	the same as soon as possible.

#### Minnesota Weather Service.

•	, Obs	erver.
Compensation ——, by ————.		
Reports of ———, on ——.	•	
Weather and flag reports and correspondence	about instruments, addressed	Signal
Officer, Minnesota Weather Service, Chamber of (		., .
All other correspondence should be addressed,		North-
fold Minn		

Application for a station at ----, instruments located at----, flags displayed on

The Minnesota weather service, under the auspices of the Saint Paul Chamber of Commerce, co-operating with the United States Signal Service and the Minneapolis and Saint Louis Railway Company.

#### CENTRAL STATION AT CHAMBER OF COMMERCE BUILDING, Saint Paul, March 1, 1886.

The director of the Minnesota weather service, with the approval of the Chief Signal Officer, Washington, D. C., has removed the central station of the weather service originally organized by Carleton College, Northfield, Minn., from that institution, and located the same permanently in the building of the Chamber of Commerce of Saint Paul. In consideration of this change, the Chamber of Commerce furnishes such aid and offers such co-operation and supervision as are necessary for the most efficient operation of a general and comprehensive weather service for the entire State.

In accordance with the above announcement, the director (in co-operation with the Chamber of Commerce committee) respectfully submits the following general statement for the information of the public:

This service consists at present of twenty-five stations partly or wholly equipped with standard meteorological instruments, purchased by the several local stations, and tested

#### STATIONS.

There should be at least one complete station in each organized county of State, under the supervision of the local board of trade, city council, or board of education, for financial support and responsible oversight.

#### OBSERVERS.

A competent and responsible person should be chosen as observer for each local station, whose duties shall be to record the readings of instruments three times daily, and report the same, with other important meteorological facts, to the central station once a week, as provided for in the instructions from the Chief Signal Office.

In order to make the weather service as largely beneficial as possible, authority sup-

porting each local station will be respectfully asked:

at the Chief Signal Office in Washington, D. C.

(1) To purchase such a set of flags as the Signal Service uses to display its indications.

(2) To prepare a bulletin board of suitable size and design, and place the same in a conspicuous place for posting daily weather dispatches.

(3) That the several stations shall cause these flags to be promptly and regularly displayed, and that all daily indications shall be placed on the bulletin board at some specified time in the early part of each day.

(4) It is also expected that each local station will bear all expenses for instruments,

taking of observations, the posting of bulletins, and the display of flags for indications and warnings.

#### CENTRAL STATION.

For remainder of this circular, see page 78.

SAINT PAUL, MINN., June 1, 1886.

SIR: I have the honor to report for May, 1886, as follows: The work performed has been to canvass the State for flag and meteorological stations for the Minnesota weather service, to prepare for publication the report issued each month by the service, to attend to correspondence, and to prepare and deliver to the various railroads telegrams giving indications for Minnesota, Eastern Dakota, and Northern Iowa.

I was absent from this station May 11, 12, and 30.

I commenced delivering messages to the Chicago, Milwaukee and Saint Paul Railway May 10, 7 a. m.; the Minneapolis and Saint Louis Railway May 24, 7 a. m; C. A. Hoffman, Minneapolis, Minn., May 3, 7 a. m.

Following is list of stations on various lines now receiving telegrams and displaying

signals:

•	Commenced	sending.
Stations.	Date.	Hour.
Chicago, Milwaukee and Saint Paul Railway: Red Wing	May 10, 1886	7 a. m. 7 a. m. 7 a. m. 7 a. m. 7 a. m.
Minnesota and Saint Louis Railway: Watertown, D. T	May 24, 1886 May 24, 1886 May 10, 1886	7 a. m. 7 a. m. 7 a. m.

The system of extending the benefits of the Signal Service to the rural districts and interior towns is decidedly beneficial to farming and other interests and highly appreciated by the general public.

Very respectfully, your obedient servant,

D. R. McGINNIS,

Private, Signal Corps, United States Army. To the CHIEF SIGNAL OFFICER, U. S. A.,

Washington, D. C.

#### OHIO.

#### OHIO METEOROLOGICAL BUREAU, CENTRAL STATION, Columbus, Ohio, June 9, 1886.

DEAR SIR: It gives me pleasure to comply with your request for information concerning the workings of this bureau for use in your report. The bureau owes its existence primarily to Prof. T. C. Mendenhall, formerly professor of physics of Ohio State University, Columbus, Ohio, now in the Signal Service Office, at Washington, D. C. His active interest in meteorology secured the interest and co-operation of the agricultural organizations of the State and resulted in the passage of an act by the general assembly April 17, 1882, creating the bureau and providing for its support. A copy of the act taken from the first annual report of the bureau is inclosed.

The first report issued was for the month of October, 1882, since which time monthly reports have been issued regularly. The bureau receives \$2,000 annually from the State, out of which instruments for the equipment of stations have been purchased and current expenses paid. The only salary paid is that of the secretary. A list of the stations reporting is inclosed. The list gives the number and location of each station, date of stablishment, latitude, longitude, elevation, and the name of the present observer. The observers are volunteers and have given their services without compensation. Their work has been done very faithfully, as the monthly reports show.

I also inclose a list of railroads carrying upon their baggage cars display signals, giving to the regions through which they run the Signal Service predictions for the day.

to the regions through which they run the Signal Service predictions for the day.

The system used is the "sun, moon, and star" set, now so well known throughout the country.

This service has given great satisfaction to the people along the lines making the dis-

play, and has called forth many warm commendations.

The bureau has from the first received substantial aid and encouragement from the Chief Signal Officer, General W. B. Hazen, without which some of its most valuable work would have been impossible. A year ago he offered to pay for daily telegrams of prediction to be sent to ten stations selected by the bureau. He has since authorized an increase of the number to thirteen. A message is received from Washington each morning, which is immediately repeated to each of the thirteen points, when the proper factor are displayed giving the predictions for the day.

A list of the places receiving these messages is inclosed, giving also the date of the first message sent and the address of those making the display.

If I have omitted anything you desire to have stated please inform me.

Very truly, yours,

BENJ. F. THOMAS, Director Ohio Mctcorological Bureau.

Lieut. H. H. C. DUNWOODY.

Annual report of the Ohio Meteorological Bureau.

In this the first annual report from the meteorological bureau of Ohio it is thought desirable to give a resumé of the history of the organization and work of the service up to the present time.

The bureau originated in the interest in scientific and practical meteorology on the part of many citizens of Columbus and the State, and in the desire of the Chief Signal Officer of the United States Army to increase the effectiveness of the national service by securing the co-operation of State organizations. A bill to bring about such an organization was introduced by the house committee on agriculture in the general assembly in the winter of 1882, and became a law on April 17 of that year.

The act establishing the bureau is as follows:

#### [House bill No. 481.]

AN ACT to establish a meteorological bureau for the State of Ohio.

SECTION 1. Be it enacted by the general assembly of the State of Ohio, That there be, and hereby is, established at the State University, at Columbus, Ohio, a central office for meteorological observation, with the professor of physics of said university, the secretary of the State board of agriculture, and a third person, to be appointed by the governor, as a board of directors; the members of the board of directors shall be commissioned by the governor, and be duly qualified as like officers of the State.

SEC, 2. The professor of physics of said university is hereby appointed president of the board, and by and with the advice of the directors shall establish, if practicable, one volunteer weather station in each Congressional district, and supervise the same; he shall receive reports therefrom, and reduce the same to tabular form and report the same monthly to the State printer for publication as the Ohio weather report, and shall annually make a report to the governor, which shall contain a detailed statement of all expenditures made during the year and a summary of the observations made at the various stations.

SEC. 3. That the supervisor of State printing be directed to print, under the contract with the State printer, 2,000 copies of each monthly report; 1,000 copies shall be distributed by said board, and 1,000 copies shall be delivered to the secretary of state, to be distributed by him in the same manner as other State documents.

SEC. 4. There is hereby appropriated for the ensuing year, for the establishment and maintenance of said bureau and stations, the sum of \$2,000, or so much thereof as may be necessary for the purpose of meeting actual expenses of carrying out the provisions of this act; no part of said sum shall be paid for salaries of any officer or for office rent, but a reasonable part of the same may be paid for the services of a clerk at the central station.

SEC. 5. No money shall be expended, except under the order of the president director, by and with the approval of the board.

SEC., 6. This act shall take effect from and after its passage.

O. J. HODGE,
Speaker of the House of Representatives.
R. A. HORR,

President pro tempore of the Senate.

Passed April 17, 1882.

The passage of this act was recommended by Governor Foster in a special message to the general assembly, and it was also unanimously recommended by the State board of agriculture.

#### List of roads carrying signals.

Cleveland, Mount Vernon and Delaware Railroad: Four trains running from Columbus to Cleveland, and all points along the road receive the benefit of signals before 8.30 a.m. Signals are changed at Columbus, Cleveland, and Akron. No observer on line at this time.

Columbus, Hocking Valley and Toledo Railroad; two divisions.

First division: From Columbus to Toledo. Two trains daily. All points along this line are reached by 8 a. m. The signals are changed at Columbus and Toledo.

signals are reported from Carey by D. Pearce, agent of the railroad.

Second division: From Columbus to Athens. Two trains daily. All points along this division are reached by the trains before 9 a. m. of each day; the signals are put on at Columbus and Athens. The observers of signals of this division are W. H. Songenecker, Lancaster, and E. B. Clark, Athens.

The signals are also received on the Monday Creek branch of this division, Columbus and Cincinnati Midland Railroad. From Columbus to Cincinnati. Two trains daily. All points along the line of this road are reached by 9.30 a. m. The signals are changed at Columbus, Cincinnati, and Blanchester. In addition to sending the signals over the road George R. Car, general superintendent of Columbus, Hocking Valley and Toledo Railroad, and S. P. Peabody, general superintendent of Columbus and Cincinnati Midland Railroad, have had the predictions telegraphed over their roads by the train dispatchers, and many points have taken advantage of this kindness and display flags.

On the Columbus, Hocking Valley and Toledo Railroad; Delaware, Prospect, Marion

and Fostoria are displaying flags, using the telegrams sent in this way.

On the Columbus and Cincinnati Midland Railroad, Mount Sterling and Wilmington are displaying flags, and Washington Court House is displaying a set of signals, as used on the baggage cars, from the telephone office, and also using a whistle, which is giving excellent satisfaction. All these points are receiving messages by the kindness of the superintendent of the railroad on which they are located.

When established.	Display stations.	Superintendents
November, 1885	Zanesville, Ohio	Lewis F. Langley.
Jaly, 1886	Canton, Ohio	S. V. Courtney.
[aly, 1886	. Wauseon, Ohio	Thomas Mikesell.
July, 1886		
September, 1885	. Youngstown, Ohio	A. G. Frost.
July 1885		Dr. D. N. Allard.
leptember, 1885	. Hamilton, Ohio	H. T. Berry.
uly, 1885		E. L. Warson.
luly, 1885		
anuary, 1896		
April, 1886	Fultonham, Ohio	C. B. Fanley.
April, 1886		
May, 1886		Aiken & Richeson.
May, 1886		J. H. Earnshaw.
July, 1886		A. T. McKelvey.

The messages were transmitted to Hillsboro and McConnellsville from Columbus until May 15, when, by order of the Chief Signal Officer, they were discontinued, and the messages are forwarded to Hillsboro from Cincinnati, and those for McConnellsville from Zanesville. The messages to Yellow Springs were discontinued on the 5th day of June by order of the Chief Signal Officer.

List of stations reporting for the Ohio Meteorological Bureau, with latitude, longitude, elevation, time of establishment, equipment, and names of observers.

# SIGNAL SERVICE STATIONS.

;	Name of observer.	Sergt. P. T. Jenkins. Sergt. P. T. Jenkins. Sergt. B. F. Hough. Sergt. A. L. McRae. Sergt. Wm. Line.
£	Equipment.	Signal Service equipment.
Date of	establish- ment.	
	Elevation	F. 88.88
	Longitude.	* \$2882 * \$3552
	Latitude.	624484 64484 64488
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	No.	1 10A 10B 13A 21A

# OHIO METEOROLOGICAL BUREAU STATIONS.

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ĉ	College Hill	8	9	•		2	7	1964	1 Bar Mar and Min Ther Hogrameter W Vans P G	Drof A D Moreill
ľα	Dieton	38	7	, ,		3	Ì	1889	_	Mice Folish
,;		3 :		, .				33	•	
4	New Bremen	₽	70			3	5		do	C. W. Williamson,
4B	Sydney	Ç	2	•		<b>E</b>	<u>~</u>			_
2	Greenville	40	1-	•	_		_	6. 1835		A. J. Katzenbarger.
5.4	Upper Sandusky	3	4 1	•		_				_
28	Findlay	7	0	•	-	35 1.200	_	b. 1836	_	J. W. Zeller.
<b>6</b> A	Wanseon	7	8	•		_	_			Thomas Milcosell.
	Paulding	7	0	•		734	_	V. 1883	_	
	Naboleon		긺	•					÷	Dr. T. C. Hunter.
	Vellow Springs		4	•		_		n. 184	÷	_
00	North Lewisburg		13	3		_		2	_	
¥6	Lavaring		8	•		_		<i>'</i>	_	
	Gambier		8	, uz					do.	Prof. Theo. Sterling.
114	Hanging Rock	23	2	œ				155	-:	
118	Portsmouth	23	4	œ		0 527		pt. 183		_
	Waverly		2	œ				c. 185	Bar., Max. and Min.	_
	Georgetown		2	36	-	_		2.7	_:	_
	Ohio State University		0	•				185		_
130	Westerville	4	œ	œ		83		c., 15.		_
13D	Logan	జ	8	90				pt., 185	<u>-:</u>	
7	Oberlin	7	6	œ				t. 155		Prof. F. F. Jewett.
15A	Marietta	æ	S	20				188	_	
15B	McConnellsville	දි	3	30	81 4		_	Mar., 1854	:	
150	Pomeroy	88	18	90	 σ	0	<del>-</del> -	Apr., 1884	:	Dr.D
16A	Granville	\$	9	œ	ထ ည	1,096	_		·	Prof. J. S. Gilpatrick.
16B	Newcomerstown	<b></b>	ឌ	æ	დ ⊒	36.		b. 1886	<u>-</u>	Dr. A.

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174 174 174 174 174 174 174 174 174 174

## RAIN-GAUGE STATIONS.

Name of observer.	D. W. Myres. C. B. Michener. D. A. Allen. B. R. Richards. B. F. Sowers. Howard S. Friend.
Equipment.	Rain gaugedo
Place.	Hudson Rain gauge D. IV. Myres Waynesville do C. B. Michen Ellsworth do D. A. Allen Ellsworth do B. B. R. Bowers Lordstown do B. F. Sowers Ainger do Howard S. F.
Name of observer.	Rain gauge
Equipment.	Rain gaugedododododododo
Place.	Troy Re Bryan Re Milmington Cedarylle Springboro Cilutonville Cilutonville Cilutonville

#### TENNESSEE.

#### TENNESSEE STATE BOARD OF HEALTH. METEOROLOGICAL DEPARTMENT,

Nashville, June 1, 1886.

DEAR SIR: I have the honor to acknowledge receipt of your favor of the 27th ultimo. I inclose herewith a copy of the State board of health bulletin for April, containing the report of the State weather service for that month, in which you will find on page 141 a list of the stations and the names of observers who have been reporting regularly and which I hope you will find satisfactory. I inclose also a list of the stations receiving the daily weather indications.

Regarding these latter, I find that the system has been most gladly and gratefully received by the citizens of the vicinity of the stations, and it has certainly proved a most effective way of popularizing the Signal Service in our State, especially in communities where many adverse criticisms had been made regarding its efficiency and benefits. Many of the citizens around these stations wonder how they have done without the sig-

nals so long.

I had quite a hard struggle about a year ago to keep the State weather service intact. The commissioner of the bureau of agriculture, having in charge the weather service. concluded to give it up as a useless adjunct to his bureau, and although I used every argument I could to dissuade him, it was a useless task, so I persuaded the officers of the State board of health to take it under their protecting care, agreeing, if they would, to do the work of correspondence and of compiling and tabulating the individual reports each month and making up the general summaries just as the work had been done by me as secretary of the bureau of agriculture. They agreed to take charge of it not-withstanding the very meager appropriation allowed for the health board, and under their charge the State service has become more popular. But before I could take charge of the work I had to promise the commissioner of agriculture that it should not interfere with my work in the bureau; therefore, I have most of the work of compiling, &c., to do at night.

I give you these facts that you may know the struggle for existence our State service My love for the service, and my great interest in it from the first, having organized it, and done all the work to the present time, with but little aid or encouragement, has prompted me to cling to it. I am confident that each year will increase its efficiency and popularity in the State. I will take pleasure in giving you any other information at any time.

Yours, truly,

H. C. BATE. Secretary Tennessee Weather Service. Lieut. H. H. C. DUNWOODY, A. S. O., Washington, D. C.

#### Stations receiving daily weather indications.

City.	County.	Remarks.
Johnson City	Loudon	East Tennossee.
Athens	Lincoln. Bedford.	
New MiddletonColumbiaNashville.	Smith. Maury.	Middle Tennessee. (Central station.)
SpringfieldGallatinClarksville	Robertson. Sumner.	(Constant Bassions)
Lexington Jackson Milan	Henderson. Madison.	West Tennessee.
TrentonUnion CityBrownsyille	Gibeon. Obion.	Appointed by C. S. O.

In response to my first request for the location of stations to receive the daily indications General Hazen very kindly permitted me to name ten stations. Soon after they were established I had several applications for additional ones, and, at my request, General Hazen permitted me to name six more. So there are sixteen (16) in the State named by me. The station of Brownsville was named by the Chief Signal Officer at the request of the postmaster. I had sent a set of flags down there at the request of one of the citizens, who promised to display them on receipt of the indications each day, but before I bad time to notify the Chief Signal Officer that Brownsville was on my list, my man wrote me that the postmaster had been appointed to display the signals, and sent the flags back to me. I was not sorry, as it gave me the naming of another station, which I did. The system is working admirably, and the people are beginning to swear by the probabilities. I inclose you one of the cards I had printed for distribution.

H. C. BATE, Secretary Tennessee Weather Service.

List of stations for the month of March, 1886, as reported to the State board of health by voluntary observers in Tennessee, in co-operation with General W. B. Hazen, Chief Signal Officer, U. S. A.

County.	Station.	Observer.		
Vashington	. Jonesboro	Robert L. Macon.		
reen	Greenville	Ephraim Link.		
awkins	Rogersville	S. M. Miller, M. D.		
nox		William O. Bailey.		
lount	. Knoxville	William O. Daney.		
nderson		J. K. P. Wallace.		
Ampbell		David Hart, M. D.		
onroe		Prof. J. L. Bachman.		
dk	Parkville	J. C. Williamson.		
		J. C. Williamson.		
organ		J. T. Cowden.		
radley	. Grief			
ledsoe	Farmingdale	Lewis Boynton.		
amilton	. (a) Chattanooga	Edward A. Beals.		
arion	. Fostoria	Charles Foster.		
utoam	. Cookville	H.C. Taylor.		
<b>ay</b>	. Clementsville			
Arren				
offee	Manchester	Wiley Hickerson.		
Do	Beech Grove	A.B. Robertson, Jr.		
nith	. Riddleton	S. P. Furgusson.		
ilson		P. B. Calhoun.		
edford	Flat Creek	l		
utherford	. Florence Station	C. F. Vanderford.		
nooln	. Howell	O. R. Hatcher, M. D.		
widson	. Nashville	L. N. Jesunofsky.		
Do	. Hardison's Mills	•		
sury	Hurricane Switch	J. A. Laughlin,		
iles	Pulaski	•		
beatham				
Laury	. Ashwood	C. F. Williams.		
ewis		R. Downey.		
iekson	Dickson	Miss Lizzie Reep.		
lickman		True million moop.		
lontgomery		John Minor.		
Vayne		C. Buchanan, M. D.		
lardin		H. R. Hinkle,		
lenry	Paris	II. II. IIIIIII		
lenderson	Lexington	Prof. S. A. Mynders.		
Arroll		A. W. Hawkins, M. D		
Veakly	Dresden	A. W. Hawkins, M. D		
		A @ Chamman		
ibeon	Trenton	A. S. Currey.		
Do	Milan	M. D. L. Jordan, M. D.		
ardeman	Boliver	C. H. Anderson.		
yer	Dyersburg	5 4 5 6 6		
'ayette		Dortch & Cummins.		
lpton		James I. Hall.		
belby	Woodstock	C. W. Graves.		
Do	.   (a) Memphis	D. T. Flannery.		

#### MICHIGAN.

MICHIGAN STATE BOARD OF HEALTH.

Lansing, Mich., June 8, 1886.

DEAB SIE: In reply to your letter of May 27, 1886, I would say that there exists no organization in the State of Michigan under the exact title of "State weather service." In the year 1877 the Michigan State board of health, in order to acquire an accurate knowledge of the climatic condition of the State, for use in connection with knowledge of its sanitary condition, in the study of the public health, instituted a voluntary meteorological service consisting at first of twelve stations. This service has been gradually increased until at present it numbers thirty-seven stations. The observers for this service are of two classes, the one being composed of the officers of the United States Signal

Service Corps who are stationed in this State, and who, by courtesy of the Chief Signal Officer of the United States Army, are permitted to furnish this office monthly with a copy of the record of their meteorological observations; the other class consists of a number of voluntary observers in different parts of the State who, without pecuniary remuneration, have consented to make and forward to this office meteorological observations at their several localities.

The last named class of observers are furnished with instruments, blank forms, and other necessary material for the work by the State board of health. The first named class use the instruments supplied by the United States Signal Service authorities, and are furnished with blank forms and ozone test paper only from this board. The observations taken and transmitted to this office by the above mentioned observers are tridaily at or near the hours of 7 a.m., 2 p. m., and 9 p. m., local time, and consist of readings of open-air and registering thermometers, psychrometer and barometer, together with a record of the per cent. and kind of cloudiness, force and direction of wind, coloration of ozone test paper, kind and amount of precipitation, and whatever casual phenomena may occur. The instruments supplied to the voluntary observers by this board are manufactured by J. & H. J. Green, of New York City, and the ozone test paper is prepared according to the Schonbein formula by Professor J. H. Long, of Chicago Medical College.

The results of the observations thus made are, when received at this office, compiled, tabulated, and graphically portrayed in diagrams, and so rendered available for the purpose for which they were intended, viz., the facilitation of the study of subjects promotive of the public health, by comparison of meteorological and sanitary conditions, and are published in the annual reports of this board. The following is a complete list of the observers reporting to this office, with the localities from which they report, arranged divisionally with regard to their geographical positions, beginning with the most northerly situated:

Name.	Place of observation.	County.
W. W. Dent*	Marquette	Marquette.
Arthur Beebe	Manistique	Schoolcraft.
M. Pindell*		Delta.
H. Cleveland, M. D		
. E. Wait		
. W. Nicholson, M. D	Boyne City	
eorge M. Chappel*	Mackinaw City	
ames J. Fitzgerald*	Alpena	Alpena.
D. W. Mitchell, M. D	Harrisville	Alcona.
oseph E. Mueller*	Grand Haven	
ohn P. Stoddard, M. D		
S. Richardson, M. D.		Osceola.
hn J. Granville	East Saginaw	Saginaw.
ohn W. Kimball	Port Austin	Huron.
Villiam M. Edmonson		
ohn S. Calkins, M. D		Lapeer.
rofessor R. C. Kedzie	Agricultural College	Ingham.
rofessor J. W. Ewing	Ionia	Ionia.
H. McCallum	Lansing	
. G. Gordon, M. D		
rofessor M. W. Harrington		
H. Kellogg, M. D		
. H. Boies		
corge C. Palmer, M. D		
7. T. Drake.	Marshall	
G. North, M. D	Tecumseh	Lenawee.
Alexander		Oakland.
B. Conger*	Detroit	Wayne.
lilton Chase, M. D.		

* United States Signal Service observers.

I take pleasure in forwarding to you the above statement in regard to the meteorological department of this board, and shall be glad to afford you any further information on the subject you may in future desire.

I may add that this branch of the work, under the direction of the Michigan State board of health, has already yielded valuable data for the study of the causation of two of the most important diseases which cause deaths in Michigan, namely, typhoid fever and pneumonia, it having been shown by means of the data thus collected that the rise and fall of the typhoid fever in Michigan is apparently controlled by the rise and fall of the ground-water, probably for the reason that when the water in wells is low the leachings into it from privy-vaults is least diluted. The causation of pneumonia appears to be in an entirely different manner, not materially influenced by the rainfall, but it is

controlled by the atmospheric temperature and humidity. As soon as its mode of causation is fully understood by the people it is hoped that many lives may be saved, even though such climatic conditions cannot be changed, except in buildings in which, after all, a large part of the time of most people is spent. The studies of the causation of other diseases are in progress.

Very respectfully,

HENRY B. BAKER,

Lieut. H. H. C. DUNWOODY, Signal Service, United States Army, Washington. D. C. Secretary.

#### MISSOURI.

The following is a sample of the monthly bulletin issued by the Missouri State weather service, under the direction of Professor Francis E. Nipher, director; Maurice Johnson, assistant:

MISSOURI WEATHER SERVICE, July, 1886.

The past month has been an exceedingly dry one all over the State, except the externe southern part, where the rainfall was nearly 6 inches at Protem, Taney County, near the border of the State. From here the fall diminished to fractions of an inch in the central and northern parts, and at three stations, viz., Chamois, Kirksville, and Pleasant Hill, no appreciable rain occurred, the report being zero.

The fall at the central station was 0.24 inch, which shows a deficiency of 3.92 inches, the normal for July being 4.16 inches. This is the least amount of rain for the month of July recorded at the central station since 1839. The next smallest July rainfall on

record is 0.84 inch for 1846 and 0.92 for 1853.

The mean temperature at the central station was 80°.4, which is 1°.2 above the normal. The highest temperature recorded was 95°.5 on the 29th, and the lowest was 65°

on the 15th, 17th, 18th, and 19th.

The mean temperature for the State was 78°.3 for the month, as deduced from the reports of eighteen observers. The same value was obtained for this month in 1885. The highest temperature reported was 106° at Miami, 104° at Protem, and 102° at Sedalia; lowest was 50° at Ironton, 55° at Steelville, and 57° at Houstonia.

The observer at Chamois remarks that "there has not been rain enough this month to wet a cotton handkerchief spread out—the driest month on record. Mean temperature a little over one degree below the normal; while the rainfall is, of course, 2.15 inches below. Corn could not make more than one-third crop if it were to rain now; yet it has not 'fired up' as badly as would be expected from so long a drought."

Lamonte.—Notwithstanding the extreme dryness of the month there is a prospect for something like a half crop of corn. Grapes are being injured by the drought, and gardens are greatly damaged. People are hopeful, however, and have been worse off in past

years.

Miami.—Wheat is good; all the grasses fine; corn, two-thirds crop without any more min; apple crop good. Hog cholera has killed over two-thirds of the hogs.

Lexisgion.—Late corn almost ruined by drought and pastures nearly worthless.

Howdonia—The close of the month finds the ground hard and dry; corn suffering

greatly for rain, and grass dry and short.

Laffin reports the corn very much damaged by drought; but hay the best ever known. Savannah reports an average crop of corn on new clover ground; but on old ground it is dried up; grass about half crop; a great number of fruit-trees dying, the ground being dried up to a depth of 4 feet.

Oregon reports this July the dryest in thirty-two years. The early corn of the county will make a good crop; late corn is "firing;" fruits are better than usual. Streams are low and pasturage suffering; many farmers are compelled to dig wells for their stock.

The following was sent in by Professor Nipher:

Ioun City, Ioun.—There has been no appreciable rainfall here during July, and the fall has not been over half an inch in all since the middle of May. Wheat, oats, and hay turned out well, the quality being excellent. The corn crop is badly damaged, the late planting being beyond help. It is already in tassel, although only 2 to 3 feet high. The early planting may yield half a crop if rains come soon. This drought extends over a large part of Central and Southern Iowa, although local rains have fallen in some parts of the State.

MAURICE JOHNSON,

Assistant in Charge.

Tabulation of obscrvations.

		Ten	peratur month.	Rain-	No. days.		
City.	Observers.	Min. Max.		Mean.	fall.	Rain.	T. L
				1	Inches.	_	١.
airo, Ill	C. L. Bozzell	62.0	92.9	78.1	1.01	5	
Corning	William Kaucher	[		• ••••	_		•••••
Centreville	M. McKenzie				_		•••••
	G. W. Dallas	64.0	99.0	77.4		0	1
3lasgow	T. Berry Smith	·····					••••
reenfield	S. B. Bowles	66.0	100.0	79.0	4.50	3	
Tarrison ville	George M. Houston	ļ	•••••		-	•••••	
Iannibal	F. W. Gill	63.0	98, 0				
Ioustonia	S. J. Spurgeon	57.0	99.0	78.1	0.06	3	
ronton	W. H. Delano	50.0	91.0	71.6	1.30	3	1
Keokuk, Iowa	Sergeant Gosewisch	58.0	97.5	77.5	0.65	2	
Cirksville	Charles Patterson	62.0	101.0	77.9		0	
Aflin	M. L. Cartwright	68.0	87.0		3.00	2	
eavenworth, Kans	L. A. Welsh	59.5	100.2	78.4	0.55	2	
exington	J. B. Alexander	62.0	95.5	77.3	0.31	4	İ
ouisiana	M. J. Hassler	l	l				
amar	J. W. Dunn	l	l				
amonte	R. A. S. Wade		l		1.70	3	
icking	J. T. Morris						
fascoutah, Ill	Theodore Englemann	61.0	101.5	81.6	0.37	1	
fexico	F. J. Llewellyn	64.0	98.0		0.03	2	
fiami	A. W. Sullivan	58.0	106.0	77.0	0.20	3	
Mound City	Lawrence Kaucher	58.0	101.0	79.1	0.32	4	
regon	Mrs. William Kaucher	61.0	98.0	78.6	0.20	3	
leasant Hill	G. C. Broadhead	66.0	97.0			ő	
rotem	Silas Turnbo	60.0	104.0	81.6	5.91	, Š	
helps City	J.S. Wade	00.0		01.0			
ledalia	C.G. Taylor	61.0	102.0	80.7	0.62	3	
teelville	E. A. Pinnell	55.0	98.0		0.20	3	l
Springfield	E. M. Shepard					"	
Varrenton	John H. Frick	64.0	98.0	75.5	l <u></u>		
aint Louis:	John H. Prick	02.0	00.0	.0.0	1		l
Central station	Maurice Johnson	65.0	95.5	80.4	0.24	2	1
Signal office	Sergeant Weber	62.7	96.1	80.4	0.50	8	i
2929 Olive street	A. W. Meston		J 50.1	50.1	1 5.50		
Water-works	A. J. Chaphe		*************************	•••••	0.58	2	
	R. Van Buskirk		101.0	************	0.30	ĺ	
avannah	J. R. Mudd				0.50	li	1
aint Charles	John S. Chandler			•••••		li	
helbin <b>a</b>	John S. Chandler		•••••	••••	0.01	1	

The sign - in the rainfall column denotes inappreciable.

#### ILLINOIS.

ILLINOIS STATE WEATHER SERVICE, DIRECTOR'S OFFICE,
Springfield, July 29, 1886.

CHIEF SIGNAL OFFICER, Washington, D. C.

DEAR SIE: In compliance with your request, I herewith inclose a short sketch of the Illinois weather service.

Hoping that it will meet your requirements, I am yours, truly,

CHARLES F. MILLS, Director.

The Illinois State weather service was organized in July, 1877, with thirteen voluntary observers, under the direction of Hon. S. D. Fisher, secretary of the Illinois State Board of Agriculture, who conducted the same until January, 1885.

A signal station was established at Springfield in 1877, and began to report to the State

director in February, 1878.

Reports were first received from the station at Cairo in May, 1878, and from Chicago in August, 1879. In January, 1885, the number of regular observers was twenty-two, which number has gradually increased until June, 1886, when reports were received from sixty-one stations, and three of the regular observers failed to get their reports in the hands of the director in time to have them incorporated in the weather review.

Three of the observers have reported to the department ever since its establishment, in 1877; three began reporting in 1878; one in 1879; three in 1881; eight in 1882; two in 1883, and three in 1884. The remaining forty began making observations within the

last eighteen months.

The Illinois department of agriculture publishes a monthly weather review of about thirty pages, which contains tables giving all the data collected by the observers, as well as a summary of the same by counties under the head of remarks, and an introduction which gives the most salient points and the phenomena of all kinds for the entire State. A summary of the observations is sent each month to all the newspapers of the county in which the station is situated, and published by them, thus giving every one in the county the benefit of them.

The review also contains a list of the stations in Illinois displaying the weather flags, which list is enlarged monthly as the people of the various towns in the State awake to the advantage of knowing the weather indications each morning. Much interest is felt in this branch of the service, and the efforts of a few enterprising men are making themselves felt over a large area of country. Illinois inaugurated the system of announcing the indications by means of steam whistles, the whistle at the deaf and dumb asylum at Jacksonville being the first one in use. A regular code of steam-whistle signals has been formed and is uniform throughout the State. The plan is found specially useful in agricultural districts, as the farmers can hear the whistle at a much greater distance than they can see the flags.

The Chicago and Alton Railroad Company has entered into the spirit of this work, and delivers the dispatches to all points on their line, where requested, free of charge.

#### COLORADO.

COLOBADO METEOROLOGICAL ASSOCIATION, Colorado Springs, Colo., June 7, 1886.

Lieut. H. H. C. Dunwoody, U. S. A.,

Office Chief Signal Officer, Washington:

I have the honor to inclose, in response to your recent invitation, an account of the organization of the Colorado weather service, and the work accomplished during the two months of its active existence to the 1st instant.

May I trouble you to insert, in the fourth line before the end, the initials of Sergeant

Notson, of Cheyenne, which are unknown to me?

I would be greatly obliged if you would tell me (unless the information is contained in forthcoming report) what steps must be taken for the distribution of weather indications in Colorado.

I am yours, very respectfully,

F. H. LOUD.

The Colorado Meteorological Association was organized at Denver, December 30, 1884, and articles of incorporation were filed in accordance with the law of the State on January 3, 1885.

These articles set forth as the object of the association the following: "Observing, collecting, recording, and publishing the meteorological phenomena, occurrences, and changes within the State of Colorado and all purposes and objects connected with, in-

cident to, or necessary for the effective carrying out of the above purposes."

The articles of incorporation provide for an annual meeting of the association, at which is elected a board of directors to take charge of the work of the association during the coming year. The directors for the first year were: Charles F. Wilson, president; Samuel A. Fisk, M. D., secretary; Prof. Sidney H. Short, of Denver University; Prof. Charles F. Davis, of the Colorado Agricultural College; Prof. Paul H. Hanns, of the University of Colorado; Prof. F. H. Loud, of Colorado College; Charles Denison, M. D.; Edwin S. Nettleton, State engineer, and Sergeant J. J. Gilligan in charge of the United States signal station at Denver. These gentlemen were re-elected at the annual meeting January 8, 1886. At the first meeting for the election of officers Prof. S. H. Short was chosen as director of observations, the duties of that office having been so defined as to embrace the general superintendence of a State weather service. The same gentleman was re-elected to this office a year later, but subsequently resigned, and in March, 1886, the present incumbent was chosen to fill the vacancy.

During the first year of the association, efforts were made to obtain State aid for the maintenance of the service, but these were unsuccessful, and the association remains dependent entirely upon the fees of members and voluntary contributions. Under these circumstances, combined with the fact that the time and attention of all the directors were engrossed with the duties of their several professions, progress has neces-

wily been slow.

At a meeting of the directors, held March 23, 1886, action was taken for the organization of the State weather service, and it was deemed best to make a beginning by the periodical publication of weather records, drawn from the observations of a few gentlemen, mostly members of the association, who were known to be ready to contribute their assistance. Accordingly a weekly record for newspaper publication, to be continued through the summer, was commenced April 13, and the first number appeared in the Denver Tribune, Republican, and the Colorado Springs Gazette. A series of monthly bulletins was begun with the number for April. To these publications, and to correspondence relating to the establishment and direction of observing stations, the work of the present director of observations has been confined. The observers who undertook to report observations from the outset of the work at the beginning of April were the following:

sery thions from the outset of the work at the beginning of April were the following:
Sergt. James J. Gilligan, Denver; Mr. W. H. Powless, Alma; A. Comstock, M. D.,
Westcliffe; F. H. Lay, M. D., Pueblo; C. B. Underhill, M. D., Salida; F. H. Loud, Colorado Springs; Capt. T. A. Cunningham, U. S. Army (post surgeon), Fort Lewis; Sergt.
T. C. Collins, Montrose; Mr. Emery P. Moon, Husted. Of these gentlemen, the first six named are members of the association. During the two months following, to June 1,
1886, the roll of observers was increased by the following names: Prof. Elwood Mead, of the State Agricultural College at Fort Collins, who contributed observations from Dolores, Colo.; W. L. Dorland, M. D., Glenwood Springs; Miss Naomi Yocum, Trinidad;
H. H. Seldemridge, who observed at a ranch near Sanborn; I. B. Perkins, M. D., Hugo; and Mr. Ignatius Zeller, Idaho Springs. By the kindness of the Chief Signal Officer, the following observers and stations of the United States service, comprising (with those at Denver and Montrose, already mentioned) all within the limits of Colorado and three in the vicinity, have been directed to aid the association, and have sent full reports of the observations taken since April 1: Sergts. T. H. Brandenburg, West Las Animas; H. Hall, Pike's Peak; J. E. Lanouette, Dodge City, Kans.; W. V. Twaddle, Santa Fé, N. Mex., and D. B. Notson, Cheyenne, Wyo.

Aside from the telegrams of the Associated Press, the weather indications of the central office are at present (June 1) received only by the observers in charge of the United States Signal Service stations.

Respectfully submitted.

F. H. LOUD,

Director of Observations, Colorado College, Colorado Springs, Colo.

#### NEBRASKA.

Nebraska Weather Service, annual report, 1885.

BOSWELL OBSERVATORY, DOANE COLLEGE, CRETE, NEBRASKA.

At the close of this, the first entire year in which the service has been under the present management, it is fitting that there should be a report upon the work done during the year at the central office. This has been nothing less than the entire overhauling and revision of the reports of observers from the year 1878 down to date, with a view to selecting out what was reliable and discarding what was not. Many of the observers were untrained in the careful methods of the meteorology of to-day. Some did not know how to make averages correctly. Several inquiries have come to this office, e. g., "how to average temperatures when some were below zero;" and it appears that some, not taking the trouble to inform themselves, had treated such temperatures as if they were above zero. Many such mistakes as this have been rectified and many other observations discarded where there seemed reason to doubt their correctness. The entire mass of individual monthly reports, about three thousand in number, have been gone over, doubtful data eliminated, many of their averages recast, and revised averages made from the whole.

Thus it is believed that the statistics for Nebraska weather for the past eight years have been put into reliable and convenient form for future reference and study, and that the tables here given may be depended upon. Any slight discordance between these

tables and previously published bulletins is thus explained.

#### PROGRESS.

There are now thirty-four stations reporting monthly, besides those merely receiving the indications and displaying signals. They cover somewhat thoroughly the southern two-thirds of the eastern half of the State, although some are scattered through the counties of Lincoln, Red Willow, Keith, and Cheyenne in the extreme west. There are three fully equipped stations, viz., the Government stations at Omaha and North Platte and the central office at Crete. Other observers are provided mainly with thermometers and rain-gauges only, though several have barometers and maximum and minimum thermometers.

#### PLANS FOR THE FUTURE.

The subject to which particular attention will be turned, now that the statistical work has been put upon a good foundation, will be the display of weather signals in various parts of the State. Several stations are now displaying cold-wave flags, and arrangements are now being made with the Chief Signal Officer in Washington by which a daily telegram will be sent to this office, and plans are being perfected for distributing the information to various other points.

#### REPORT OF OBSERVERS.

The monthly reports, even of observers provided only with thermometers and rains gauges, are somewhat full, as may be seen by the inclosed form of blank used by thiservice.

#### CROP REPORTS.

Observers, many of them farmers, are asked also to furnish monthly reports of the condition and prospects of crops, fruits, &c., for publication in the monthly bulletin.

#### WEATHER INDICATIONS.

Besides the central station the following observers receive the daily indications and display signals under the direction of this service: J. B. Parmelee, Nebraska City; Albert Watkins, Lincoln; S. S. Kauffman, Stromsburg; S. L. Brass, Juniata; Thomas Shryock, Louisville; Iaeggi F. Sheepbach, Columbus; C. L. Howell, Grand Island; W. A. Wagner, Beatrice; T. J. Pickett, jr., Ashland; F. L. Wheedon, York.

The following also receive the indications and display signals, though not reporting to this office: W. W. Watson, Fairbury; A. Minnick, Falls City; Kenny & Steward, Blair.
Until debarred by the late decision of the Postmaster-General there were sent out daily on the mails East, South, and West, to all post-offices which could be reached by 6 p.m. (about sixty in number) the special 10 a.m. predictions, a card being used for

this purpose. The following is the present list of observers:

Mean Temperatures.—Crete, C. E. Chadsey; Omaha, A. Pollock; Central City, C. Shieldstream; Dawson, M. L. Libbee; De Soto, Charles Seltz; Falls City, Jennie Keim; Fremont, I. E. Heaton: Harvard, M. F. Wistrom; Lincoln, H. H. Wing; Minden, Joel Hull; Mission Creek, M. K. Walker; Nebraska City, J. B. Parmalee; Ogalalla, Dr. L. M. Line; Sargent, S. W. Perin; Stromsburg, S. S. Kauffman; Syracuse, P. W. Risser; Weeping Water, G. Treat; West Hill, J. L. Truman.

Noon Temperature.—Ashland, George Shedd; Beaver Creek, E. Smith; De Witt, F. C. Ware; Fairbury, Dr. Humphrey; Keene, Addie Le Bar; Marquette, J. Ellis; Neligh, H. C. Huxford; Red Willow, Mrs. R. Buck; Stockham, J. W. Gray; West Point, E. G. Bruner; York, D. P. Nicholson.

Also—North Platte, J. Fitzgerald; Purdum, T. C. Jackson; Hay Springs, William

Waterman; Pleasant Hill, Charles Ingles; Hannah Thompson, Mead.

Through the kindness of the Chief Signal Officer the various publications of that office are sent to this office for distribution to the observers. We seek in various ways to interest and inform the observers upon meteorological topics; a convention for this purpose and for considering plans for the future is called to meet at Crete in July, and it is intended to make these gatherings annual.

#### FINANCES.

This being a volunteer organization the expenses of the central office are borne by Doane College, with which said office is connected; and the instruments are owned by the various observers.

#### PUBLICATIONS.

A monthly bulletin is published by the central office, and furnished to observers, to chiefs of other weather services, and to the press.

GOODWIN D. SWEZEY. Director Nebraska Weather Service.

#### INDIANA.

The following is a synopsis of the monthly bulletin issued by the State weather service of Indiana, under the direction of Prof. H. H. Houston, of Purdue University, Lafayette, Ind.

Monthly Meteorological Summary from Stations of the Indiana Weather Service, for June, 1886.

[From reports received at the State Station, Purdue University, Lafayette, Ind.]

	;			mpe ture	ra-	including snow.	Specia heav	lly y.	۱.		
Stations.	Observers.	Notes.	Highest.	Lowest.	Mean.	Rainfall, inc	Amount.	Dates of hall.	ું	Dates of thunder storms.	
Southern counties.			0			Ins.	Inches.				
Columbus, Bartholomew	J. A. Perry	a	86.	48.	70.4			27	········	0 12 14 15 00 )	
Marengo, Crawford	J. M. Johnson	a,f	91.	54.	72.3			27		2,13,14,15,20 24,25,27,29	
Blue Lick, Clarke Huntingburgh, Dubois Brookville, Franklin	G. Poindexter George P. Moog A. W. Butler	a		52. 54. 53.	71.4	10, 09 7, 04 6, 23	1.73	27 27 16		1, 9, 13, 24, 29	
Princeton, Gibson	Elisha Jones	a	94.	55.	71.3		1	13 27	} 2	2, 9, 13,22,26 2, 9, 13 }	
Butlerville, Jennings	Joseph Hole	a	90.	52.	71.1	8.51	2.28	15		15, 25, 26	
Vevay, Switzerland	C. G. Boerner	a,b	86.	51.	70.6	7.39	2.25	27	2	2, 9, 13, 15 23, 26	
Degonia, Warrick Salem, Washington	James P. White James W. May	a	88. 84.	58. 56.		5, 81 8, 92	1.47 2.21	14 13		8, 24, 25	
Southern counties		ļ. <b></b>	94.	48.	70.9	7.21					
Central counties.							ĺ				
Frankfort, Clinton Connersville, Fayette Worthington, Green	E. H. Staley Robert Hessler Dr. W.B. Squire. L. M. Wainright Dr. S. S. Boots	a a	88. 86.	55. 53. 5	68.3 69.6			13 27	25	8, 13, 23, 25 2, 9, 13, 16	
Noblesville, Hamilton Greenfield, Hancock Spiceland, Henry Franklin, Johnson	William Dawson. D. A. Owen	a a,b a	90. 93.	55. 42.	69. 9 67. 5	6.01	2.02	13 9	••••••	2	
Indianapolis, Marion	C. Wappenhans	d,b	89.	1	69. 2	ı	1.57	13		2, 13, 17, 24, 25 2, 9, 13, 14 }	
Greencastle, Putnam Farmland, Randolph	O. Parker W. J. Davisson	d,b	84.5	44.	68. 5 66. 5		1.12	13		15, 22, 24, 26	
Mauzy, Rush	E. Kirkwood	a	88.	37.	66.9			9	23, 25	2, 9, 13, 15 }	
Knightstown, Rush Lafayette, Tippecanoe	D. L. Lughlain H. A. Huston	b,e a,b b,h	92.8		68, 9			13	رع , دت	23, 25, 26 }	
Richmond, Wayne	J. M. Gluys	a	86.	50.	66.0	1000		9	25	2,9,13,14}	
Dana, Vermilion	Frederick Rush	a.f	1	44.	68.5			14		17,24,25 { 13,14,24	
Central counties		ļ	93.	37.	68, 2	5, 46			ļ		
Northern counties.							1				
Fort Wayne, Allen Delphi, Carroll	W. F. Yoeum R. L. Higginboth-	a a	93.	51.	67.9	2,92	. 97	13		13, 16, 21	
Logansport, Cass	am & Son. Thomas B. Helm.	a	92	44.	71.9	4.45	1.75	13		16	
Marion, Grant	S. R. Fankboner	i	80,	50,	65.7	3. 20	. 80	13 24	}		
La Grange, La Grange	R. H. Rerick	a	88.	42.	66.7	4.50	1.70	15	ļ	ļ	
Miami, Miami Monticello, White	Isaac Records W.S. Bushnell	a,f	89,	48.	68.5	3.00	1.81	13	.' 		
Northern counties			93.	42.	68.1	3.55					
Northern counties			93.	42.	68.1	3.55					
Central counties			93. 94.	37. 48.	68. 2 70. 9	5.46				***************************************	
State			94.	37.	69.1	5.41				1	

## Note.—Frost June 4. BAROMETER.

	Mean.	Highest.	Date.	Lowest.	Date.	Range.
	Inches.	Inches.		Inches.		Inches.
Vevay	80.003	30, 200	3	29.780	16	, 120
Spiceland	30,050	30, 230	3	29, 870	15	. 360
Indianapolis	29.951	30, 196	3	29, 677	16	.519
Greencastle	29, 945	30, 190	3	29, 689	16	.501
Lafayette	30.042	30. 260	3	29.791	16	.469
State	30,000	80, 260		29,677		. 583

#### Monthly Meteorological Summary, &c.—Continued.

#### WIND.

	Total miles for the month.	Mean daily velocity.	Mean hour- ly velocity.	Maximum velocity.	Date.	Prevailing direction.
Indianapolis	3117 3227 3731	103.9 107.6 121.4	4.3 4.5 5.2	18 N. W. 15 N. 19 W. 25 S. W.	17 16 17 25	S. E. S. W. N. E.

a. Observations at 7 a. m., 2 p. m., and 9 p. m. b. Highest and lowest from self-registering instruments. c. Observations at 7 a. m., 12.30 and 9 p. m. d. From reports of signal officers. c. Observations at 7 a. m. and 7 p. m. f. Lowest temperature from special observations. g. Lowest temperature from self-registering instruments. h. Observations at 7 a. m., 1 p. m., and 9 p. m. i. Observations at 7 a. m. and 6 p. m.

The mean temperature of the State for June, 1886, was 1.2° below the mean of June for the past four years, 3.0° below the mean of sixteen years at Indianapolis, 4.8° below the mean of thirty-one years at Logansport, 5.0° below the mean of twenty-one years at Vevay, 1.4° below the mean of thirty-two years at Spiceland, 3.0° above the mean of seven years at Mauzy, 2.7° below the mean of nine years at Blue Lick, 3.5° below the mean of four years at Worthington, 0.5° below the mean of four years at Connersville, 0.7° below the mean of seven years at Lafayette, and about 3.4° below the normal temperature for June. The mean temperature at the various stations was below the normal, the amounts ranging from 0.9° to 3.5°.

The mean rainfall for the State was 0.85 inch above the mean of June for the past four years, 0.22 inch below the mean of fifteen years at Indianapolis, 1.48 above the mean of thirty-one years at Logansport, 0.53 above the mean of twenty-years at Vevay, 0.67 above the mean of twenty-eight years at Spiceland, 0.01 below the mean of six years at Mauzy, 0.79 above the mean of four years at Blue Lick, 0.29 above the mean of four years at Connersville, and 0.25 below the mean of seven years at Lafayette. The rainfall has been unequally distributed throughout the State; at most stations it has been in excess of the normal, while at Indianapolis it was 0.71 inches below the normal, and at Lafayette 3.06 inches below. A severe hail-storm did considerable damage near Connersville on the 25th.

Solar halos were reported on the 12th, 15th, and 19th; lunar halos, on the 12th;

surors on the 4th, 5th, and 29th.

The mean barometer was about .02 inch below the normal.

H. A. HUSTON, Chief State Weather Service.

#### AMERICAN HORTICULTURAL SOCIETY, Greencastle, Ind., June 1, 1886.

DEAR SIR: In reply to your request of May 27, for information concerning the "Indiana weather service" of this place (De Pauw University), I would say that our first published monthly summary was for September, 1884, since which we have issued regular bulletins which have been fully distributed throughout our State, and, indeed, to all sections of the country, where they have been highly appreciated by scientists and others, students of meteorology.

Our own organization has no legal status, the State having, thus far, done nothing in support of a bureau of meteorology, although an effort was made during the last general sembly, which came near succeeding, the bill having passed the house of representatives, but so near the close of the session that it was lost in the hurry and rush at the close of the senate. Our work is, therefore, purely voluntary, the whole expense and support of the service being by the De Pauw University, a private institution of learn-

ing under the control of the Methodist Episcopal Church.

During the year our service has been very greatly improved and several new stations added, the whole number of co-operating observers now being thirty-seven, from almost as many counties of the State. These reports are summarized in a highly condensed form and published, as noted above, monthly. For convenience, and to more clearly exhibit the gradual change of climate incident to the varying latitude of our State, these reports are arranged in three sections from the northern boundary of the State southward, the means of each section being shown separately, a form of publication which is rapidly gaining popularity with similar services in other States.

Another original feature of our reports is the column of distances, in miles, of the various stations from the northern boundary of the State.

Our reports are also printed on flat sheets, of uniform size, which may be easily and conveniently filed and preserved for reference, each single page being a complete report within itself. A comparison is also shown for each of the stations of long continuation, with the means and extremes of corresponding months for the series of years recorded.

As a measure of still further interest, especially to many who desire from various causes to study the meteorological character of other sections of our country outside the State, we have arranged through the courtesy of the Chief Signal Officer to secure reports from signal stations at distant points, which reports are published in connection with our monthly bulletins. Under the head of "remarks" each bulletin contains, in addition to an editorial leader, on some special topic (usually appropriate to the particular season) of meteorology, which is calculated to stimulate an interest in this science, a general digest of the report, giving prominence to any special features which may not be made sufficiently clear in the tabulated form.

Below I give the name and address of our co-operating observers, with distance in

miles from the northern line of the State, arranged from the north southward.

R. H. Perick, La Grange, 9; L. Stealy, Angola, 10; J. A. Varier, North Liberty, 16; N. L. Kithkart, Columbia City, 42; Professor W. F. Yocum, Fort Wayne, 48; Thomas B. Helm, Logansport, 70; W. S. Bushnell, Monticello, 71; I. Records, Miami, 80; R. L. Higginbotham & Son, Delphi, 82; Prof. H. A. Huston, Lafayette, 93; L. W. Cates, Muncie, 108; W. J. Davidson, Farmland, 109; S. D. Symmes, Crawfordsville, 119; William Dawson, Spiceland, 134; J. M. Gluys, Richmond, 135; Dr. S. S. Boots, Greenfield, 137; Sergeant C. F. R. Wappenhans, Indianapolis, 139; R. M. Ragan, Fillmore, 144; Sergeant O. Parker, Greencastle, 147; R. Hessler, Connorsville, 148; E. Kirkwood, Mauzy, 149; Professor D. A. Owen, Franklin, 158; Mrs. L. F. Hager, Terre Haute, 159; D. F. Ferris, Sunman, 175; J. A. Perry, Columbus, 177; J. B. Ward, Guilford, 179; Dr. W. B. Squire, Worthington, 183; J. Hole, Butlerville, 190; E. Wells, Commiskey, 202; C. G. Boerner, Vevay, 209; J. W. May, Salem, 217; G. Poindexter, Blue Lick, 225; J. M. Johnson, Marcngo, 233; E. Jones, Princeton, 234; L. C. Loomis, Jeffersonville, 232. 238; G. P. Moog, Huntingburgh, 239; James P. White, Degonia Springs, 256.

As yet no special arrangements have been made for furnishing stations, outside of

one in this city, with daily weather indications.

For repeated favors shown this service, it is greatly indebted to Chief Signal Officer General W. B. Hazen, yourself, and others connected with the service at Washington; also to Sergeant O. Parker at this station, and Sergeant Wappenhans at Indianapolis.

Yours, very respectfully,

W. H. RAGAN, Director Indiana Weather Service.

Lieut. H. H. C. DUNWOODY, Signal Office, Washington, D. C.

#### DAKOTA.

TERBITORY OF DAKOTA, DEPARTMENT OF IMMIGRATION AND STATISTICS, Huron, June 1, 1886.

DEAR SIR: I have your favor of May 13, with stated inclosures; I beg to assure you of my great interest in the proposed enterprise, and of my desire to be of all possible service to you. I am sure our people will take hold of the matter, and I shall do what I can to bring it to their attention. I would like to be advised whether it is your purpose to furnish all of the stations situated on railroads, including the Deadwood and Fort Totten stations, with these forecasts, and also how great an area is held to be included in "Eastern Dakota," and if other areas are to be similarly supplied with these daily forecasts. Please inform me fully on this head. I shall be as active as I can in extending the co-operation and assistance of this office. I think the great benefit to our farmers, particularly, will be fully appreciated by our railroad companies, and they will very generally provide for the transmission of dispatches over their own telegraph lines. As soon as I know definitely as to the purpose of your office as to the above, I will be glad to call the attention of the railroad companies to the matter and invite their aid. I should like to receive your suggestions and advice with respect to making every possible effort I can to render the above undertaking a success.

Yours, very respectfully,

LAUREN DUNLAP.

Lieut. H. H. C. DUNWOODY, Acting Assistant Chief Signal Officer, Washington, D. C. TERRITORY OF DAKOTA,
DEPARTMENT OF IMMIGRATION AND STATISTICS,
Huron, June 23, 1886.

DEAR SIR: I have yours of May 27th, only now received on my return from the East, the letter not having been forwarded to me, through a mischance, consequently I am

unable to forward the report in time for your use on July 1.

The "Dakota Weather Service" was only established in August last, and is yet in its infancy. Little has been done, except to publish the summary obtained through the reports of the United States Signal-Service stations at Yankton, Deadwood, Huron, Fort Sully, Bismarck, Fort Buford, Fort Totten, Moorhead, and Saint Vincent, furnished

this office by order of the Chief Signal Officer.

I have endeavored to supplement the tables used with a text that might be read and serve to interest people generally in the subject of the weather, and the importance and value of the Signal Service. I think some progress in this direction has been made, and I believe that with a little effort the daily forecasts of weather now furnished through the Huron station, may be made very useful, and become popular for that reason, as indicated in my letter of June 1, your reply to which I am awaiting with interest, that I may be of what service I can to you in this highly important enterprise.

Yours, very respectfully,

LAUREN DÜNLAP.

Lient. H. H. C. DUNWOODY,

Acting and Assistant Chief Signal Officer, Washington, D. C.

#### GEORGIA.

STATE OF GEORGIA,
DEPARTMENT OF AGRICULTURE, Atlanta, May 31, 1886.

DEAR SIR: In reply to yours of the 27th, I beg to submit the following history of the Georgia State weather service:

Observations were instituted in February, 1876, at Atlanta station, by Prof. P. H. Mell, Jr., under the direction of Hon. Thomas P. Janes, commissioner of agriculture. Professor Mell was succeeded as observer in 1877 by R. J. Redding, then clerk of the state department, now assistant commissioner, and have been continued by him to date. A few out-lying stations were reported during the years 1877 and 1878, and in April, 1878, a regular corps of observers was organized, covering all parts of the State. The territory was divided into five sections, as appears by reference to the accompanying map. In the fifth annual report of my predecessor, Hon. Thomas P. Janes (of which I send you a marked copy), he gives a short account of the establishment of the service, and in Circular No. 62 appears the first annual "summary," embracing from April to December of that year. The paragraph in the report referred to states the prime object of the work thus undertaken, and that the same has been accomplished, and the results given to the public in the recent publication of this department, entitled "The Commonwealth of Georgia," of which you probably have a copy (I sent one to General Hazen). The little map inclosed herewith is one of a series of maps that illustrate the work.

The service has been continuously kept up since its first organization, though with many changes in observers, and a gradual reduction of the whole number. Circular No. 74 shows the organization for 1885. If you have not access to the copy of the "Commonwealth of Georgia" alluded to, I will on notice send you a copy for your own use.

I have no official means of knowing whether any of my observers are furnished with the weather indications. They are not furnished through this office.

Very truly, J. T. HE

J. T. HENDERSON, Commissioner.

Lient. H. H. C. DUNWOODY, Office Chief Signal Officer, Washington, D. C.

Meleorological Stations of the Georgia State Weather Service.

As indicated in the last annual report, a system of meteorological observations has been inaugurated, embracing the entire State; and for this purpose forty-nine stations have been established, as follows: In North Georgia—Blairsville, Canton, Dahlonega, Dalton, Dillon, Gainesville, Leo, Mount Airy, Rabun Gap, Rome, and Trenton—11; in Middle Georgia—Athens, Atlanta, Carrollton, Elberton, Greensboro, Greenville, Griffin, La Grange, Macon, Milledgeville, Oxford, Talbotton, and Thomson—13; in Southwest Georgia—Albany, Americus, Bainbridge, Butler, Columbus, Cuthbert, Nashville, Quitman, Thomasville—9; in East Georgia—Augusta, Dublin, Hawkinsville, Louisville, McRae, Ogeechee, Sandersville, Swainsboro, Waynesboro, and Walthourville—10; in Southeast Georgia—Baxley, Blackshear, Brunswick, Dupont, Savanuah, and Saint Mary's—6; total, 49 stations.

Each observer is supplied with a thermometer and rain-gauge, all of uniform pattern, and made to order for the use of the department. Observations on the thermometer are made at stated hours, three times daily, in accordance with the system first devised by the Smithsonian Institution; the rainfall, the direction of the wind, and the weather are also noted, together with general remarks on the condition of growing crops as affected by meteorological conditions.

These observations are all entered in a record book (also especially prepared for the purpose), and monthly transcripts of the same sent to the department. reports are consolidated and a general summary of the same published in the current crop reports. At the end of each year it is proposed to consolidate the monthly reports and enter them in a book to be prepared for the purpose. The original reports will be bound

in one volume, and filed for future reference.

These observations will be useful in ascertaining accurately and absolutely the climatic features of the State, their diversity in the different sections, and the comparative mildness of the climate of all. They will become more and more valuable as the period of time covered by them is lengthened and the mean results become more accurate and reliable. Meteorological observations also reveal the peculiar conjunction of circumstances of rainfall and temperature, and their monthly distribution which are found to exist in connection with successful tillage of certain crops, &c.

The most immediate practical benefit, however, to be expected from these observations is in the information afforded to those who contemplate immigrating to this State. Many of these have very erroneous ideas of our climate, based as they are solely on the knowledge of the latitude of the State with reference to the prevailing climates in simi-

lar latitudes elsewhere.

#### KANSAS.

WELLINGTON, KANS., June 7, 1886.

SIE: In answer to your request—communication dated Signal Office, Washington, D. C., May 27, 1886—I have the honor to respectfully submit to you the following report, relative to the operations of the Kansas State Weather Service, as conducted by the aid of the co-operating observers located in different parts of the State, as seen in the

appended list.

The Kansas weather service, under the present arrangement and operation is, however, quite limited in extent; its first inception dating from the beginning of 1885, when the writer addressed a circular to some fifteen observers located in the State, who were keeping open records of the weather. The object of the circular was to request these observers to forward to us a monthly report of the local weather, &c.; all of which were compiled and published at the close of each month in a paper called the "Kansas Weather Observer," a copy of which was furnished free to each contributing observer.

The facilities for publishing these observations are quite inadequate to the demand, as we find that each observer's individual work is worthy of preservation for its value as a

local climatological record.

The neglect of our State officials to provide for the equipment and proper maintenance of a service of this kind, is not in keeping with the advances made by the State in the development of agricultural and educational institutions. We should bear in mind and strive to emulate the example set us by several other States, in making liberal provision for carrying on such work as this.

We have now within the State about thirty-eight observers, nearly all of whom are icient and competent to furnish complete weather reports. The following is a list of efficient and competent to furnish complete weather reports. observers who have been furnishing monthly reports for publication in "Kansas

Weather Observer:''

Place.	County.	Observers.
Allison Westmoreland Leavenworth Salina Lawrence Wyandotte Sherloek Dodge City Ninnescah Wellington El Dorado En Dorado En Dorado Rupporla Yates Centre Fort Scott	Pottawatomie Leavenworth  Salina. Douglas (Lawrence University). Wyandotte. Finney Ford.  Kingman Sumner. Butler. Butler (State Normal Academy). Woodson. Bourbon.	L. A. Welsh (Sergeant, Signal Corps, U. S. A). J. H. Gibson. Prof. F. H. Snow. E. R. Heath, M. D. J. W. Gregory. J. E. Lanouette (Sergeant, Signal Corps, U. S. A). E. Shaw. J. H. Wolfe. H. C. Ford. Prof. T. H. Dinsmore. F. R. Gray. E. Watson.

In illustration of the character of the work I append herewith notes taken from

"Kansas Weather Observer" for April, 1886.

Reports for the month were received from eleven stations. The mean temperature for the entire month, as deduced from these observations, was 53°.4, which is about 1°.5 below the normal for April. The maximum temperature, 75°, was from the 18th to 23d; the maximum range, from 11° to 23°, on the 4th and 6th, reaching the lowest over the northeast portion of the State.

The greatest precipitation in the State covered the area over the north tier of counties, and a semi-circular area from southwest of Leavenworth to El Dorado; then southeast to Independence; this area averages from three to five inches, while over all other portions of the State the average was slightly more than one inch. The average for the State as

a whole was three inches, which was about the normal rainfall for April.

High or violent winds were quite below the usual average. Characterizing the month as being generally calm, or otherwise, denoting the absence of any dangerous storms.

Telegraphic reports were ordered for Wellington cold-wave station since October 1, 1885; all dispatches were promptly attended to during the following winter. There is scarcely an industry but what has been greatly benefited by these cold-wave signals.

Yours truly.

JOHN H. WOLFE.

The CHIEF SIGNAL OFFICER, U. S. A.

#### CONFERENCE OF STATE SERVICES.

Report on the Conference of State Weather Services, held at Washington, D. C., February 24 and 25, 1886.

It having seemed advisable to call together the directors of the various State Weather Services for mutual conference and discussion, the following letter was prepared and sent on November 23, 1885:

> SIGNAL OFFICE, WAR DEPARTMENT, Washington City, November 23, 1885.

SIE: It has been suggested that a meeting of the chiefs of the local State Weather Services at some convenient time during the coming winter would result in much good to the general service, and also assure a greater uniformity in the methods of making observations and reports and the display of weather signals.

I am desirous of aiding the local State organizations, thereby increasing their usefulness, and would be pleased to meet you in this city, where matters of general interest

could be discussed, which would prove advantageous to all concerned.

Please favor me with your views on the subject, and if the proposition meets with general favor I will issue a circular announcing that such a meeting will be held, fixing a date which will be most convenient to those interested.

· A sufficient number of replies commending the purpose of such a conference, having been received, the following circular letter was prepared and sent to all interested:

SIGNAL OFFICE, WAR DEPARTMENT.

Washington City, February 2, 1886.

SIR: You are respectfully invited to attend a meeting of the chiefs of State weather services, members of meteorological societies, and others specially interested in the meteorological work of State or local organizations, to be held in the lecture-hall of the Smithsonian Institution on Wednesday and Thursday, February 24 and 25.

A general discussion of the various subjects which may be suggested at this convention will doubtless result in uniform methods of observing and recording observations, and it is also believed that by a general interchange of views on the subject of Signal Service reports and special weather forecasts, these reports may be made more valuable to your section through improved methods of distribution which may be, suggested in this discussion.

I am, very respectfully, your obedient servant,

W. B. HAZEN,

Brig. and Bvt. Maj. Gen'l, Chief Signal Officer, U. S. Army.

In response to this call a large number of persons specially interested in this work assembled at the conference in Washington City on February 24 and 25, 1886.

The following is a list of topics that were suggested as suitable for discussion before the conference:

Suggested topics for discussion at the conference of officers of State weather services, members of meteorological societies, and others especially interested in the meteorological work of State or local organizations, held at Washington on Wednesday and Thursday, February 24 and 25, 1886.

- 1. Subjects and times for observation, with object of increasing uniformity in work,
- 2. Location of instruments, especially of rain-gauges.
- 3. Form of publication of results.4. Forms of weather signals.
- 5. Scale for estimating wind velocities.
- 6. Possibility of term-day observations, as suggested in American Meteorological Journal, page 155, 1884.
  - Increase of thunder-storm observations.

Other subjects as suggested by members of the conference will be considered during the meeting.

W. B. HAZEN.

Brig. and But. Maj. Gen'l, Chief Signal Officer, U. S. Army.

The following is an abstract of the minutes of the sessions of the conference, containing a brief resumé of the subjects discussed and the action recommended:

Present: General Hazen, Professors Mendenhall, Payne, Mell, Upton, Thomas, Fuertes, Davis, Marvin, and Russell; Lieutenant Dunwoody, Messrs. Henderson, Redding, Rotch, Gillingham, Ellsworth, and Noyes.

The meeting was opened by General Hazen, Chief Signal Officer, at 10.30 a.m. Feb-

ruary 24.

Prof. T. C. Mendenhall was chosen chairman and Prof. W. M. Davis, secretary. Professor Mell moved that the printed list of topics for discussion form the order of

business for the meeting. Carried.

Professor Upton moved that any additional subjects for discussion be given to the chairman in writing. Carried.

After discussion by Messrs. Upton, Payne, Russell, and Thomas, it was voted that the conference recommends volunteer observers to read their maximum and minimum thermometers at the latest observation of the day, preferably at 9 p. m. The hours for regular thermometric observations were discussed by Messrs. Davis, Mell, Upton, Thomas, and others, and on the suggestion that error might arise by replacing local with standard time, the question was postponed until the afternoon session for further considera-

Lientenant Dunwoody asked for suggestions concerning record Forms 122 B, C, D, E, of the Signal Service. After discussion by Messrs. Mell and Redding, Messrs. Dunwoody, Mell, and Upton were appointed a committee to report on these forms, and on a record-book for the observers' property, at the last session of the conference.

Adjournment at 12.15 to meet at 1.30.

#### SECOND SESSION.

Present: Fuertes, Rotch, Thomas, Dunwoody, Russell, Ferrel, Marvin, Mendenhall, Upton, H. A. Hazen, Redding, Payne, Mell, Davis, and Noyes.

Meeting called to order by the chairman at 1.45.

Professor Upton reported that the mean monthly temperature determined by observations at 7 a. m., 2 p. m., and 9 p. m. would not differ by more than  $0^{\circ}$ ,  $2^{\circ}$ , F. from those at 6.30 a. m., 1.30 p. m., and 8.30 p. m.

Voted, that the conference recommends volunteer observers to make their regular tridaily observations of temperatures at 7 a. m., 2 p. m., and 9 p. m., local time, or by the

standard time of their meridian.

The location of rain-gauges was then discussed by a number of members, but no action

The cost of gauges and the measurement of snow was then discussed without any rec-

The location and exposure of thermometers was next considered. Messrs. Mell and Redding reported that the temperatures reported by "cotton-belt" observers were genetally too high. Professor Mendenhall recognized the error and hoped to see it corrected.

At the suggestion of Lieutenant Dunwoody the time of the conference was given to

Mr. Issac P. Noyes to read a paper on "Improvement of the weather service."

The question of weather signals awakened a considerable discussion. Messrs. Davis, Thomas, Mell, Dunwoody, and Woodruff were appointed a committee on weather sigmak to report progress at the last session and further to consider the matter.

Adjournment to meet at 10 a. m. February 25.

#### THIRD SESSION.

Meeting called to order at 10.30 a. m., February 25.

Present: Messrs. Mendenhall, Mell, Fuertes, McAdie, Thomas, Marvin, Rotch, Gillingham, Huston, Payne, Upton, Dunwoody, Woodruff, Redding, Hazen, Craig, Ellsworth, and Capen.

After reading minutes of the previous session, the question of the form and location of

min-gauges was again considered.

Voted, after detailed discussion, the conference recommends that, when practicable, rain-gauges be placed with the collecting edge one foot above the ground, and that it mend at least twice as far from adjacent objects, such as trees, buildings, fences, &c., as the heights of those objects.

The conference disapproves roof exposure.

The conference recommends that the new form of Signal Service gauges be taken as a standard and that all observers be requested to conform as nearly as possible to this pattern.

No action was taken on hours of measuring rain or scale for wind velocity.

(Report of On motion, the reports of committees prepared for last session were read. progress of committee on signals is hereto appended.) Adjourned at noon to 1.30 p. m.

#### FOURTH SESSION.

Meeting called to order at 1.45 p. m.

Present: Messrs. Mendenhall, Davis, Mell, Fuertes, McAdie, Marvin, Rotch, Gillingham, Thomas, Abbe, Upton, Dunwoody, Payne, Russell, Woodruff, Huston, Finley, Walshe, Ferrel, Day, Hazen, Noyes, Nichols, Capen.

The plan of appointing special term-days was explained by Mr. Davis, and, after brief discussion, Lieutenant Dunwoody thought it could be carried out by special arrangements with Signal Service.

The observation of thunder-storms was described by Messrs. H. A. Hazen and Davis. Organization of State services and forms of publication were considered, but no action was taken.

Report of committee on weather signals was accepted, and its recommendations (2)

adopted, and the committee was "continued till discharged."

Messrs. Mendenhall, Fuertes, Dunwoody, Upton, and Payne were appointed a committee to consider plans for the permanent organization of this conference, and to report thereon at a future meeting.

The committee on weather signals was instructed to report to the Chief Signal Officer on the result of its investigations and on the recommendations that it finally has to make. Lieutenant Dunwoody explained, in answer to inquiry, that volunteer observers are now generally requested to report to local weather services, if existing in their State.

The secretary was instructed to prepare an abstract of the proceedings of the conference for publication in the American Meteorological Journal and in Science, and to tender the thanks of the conference to the Director of the National Museum for his courtesy in providing a place of meeting.

Adjournment at 4.5 p. m., to meet again at the call of the committee on permanent

organization.

W. M. DAVIS, Secretary.

### COMMITTEE ON WEATHER SIGNALS-REPORT.

That the elements of weather signals to be indicated by signals should be: 1, fair or clear; 2, local rains; 3, general rains; 4, 5, 6, higher, stationary, lower temperature; 7, cold wave; and that these should be defined by Indications Board of Signal Service.

"Followed by" can be represented if needed; but it is the sense of the committee that the morning flags should indicate the weather for afternoon and evening; and noon flags should indicate the weather for the next forenoon. The signals should combine the qualities of visibility, cheapness, and simplicity; they should be adaptable to the various forms of display, as on poles, street ropes, railroads, and should be open to extension by addition. In order that so good a color as red should not be lost, it is recommended that red and orange be equivalent, the former for general display, the latter for railroads.

It is recommended that the Chief Signal Officer be requested to undertake experiments that shall determine the relative visibility of colors and different patterns of signals, especially as regards the pattern flags of the Ohio system, the solid colors of the Alabama system, and the proposed drum and cone system; and that he be further requested to send out a circular letter to the several services using weather signals, asking for information regarding the signals in use and for criticism and suggestions in regard to them.

The committee feeling that any system now recommended should be one for permanent use, desires to proceed slowly in its action and to collect evidence as fully as possible before coming to any decision.

It is probable that several months may be needed for this purpose.

W. M. DAVIS, Chairman.

At the first session of February 24 no stenographer was present, but the action taken has already been given in the abstract of the minutes.

The following is a detailed statement of the discussions held at the last three sessions: At the second session, Wednesday afternoon, the second topic of discussion, "Location

of instruments, especially of rain-gauges," was considered.

Professor Upton, Rhode Island, thought the first thing to know is what rule is adopted by the different services in the location of their rain-gauges. It is the custom of the observers of the New England service to place the gauge on the ground, and not on the roofs of buildings, the rim of the gauge being one foot above the ground. The reason for adopting this rule is to accord with the custom in certain European countries. It is the custom in England to have the top of the rain-gauge one foot above the ground. He did not make any recommendation, and would like to have the subject discussed. He thought roof exposures of rain-gauges unreliable, due mainly to air-currents.

Professor Payne, Minnesota, said the custom of his service was essentially the same as in New England, the gauge being located one foot above the ground and in localities free from trees and buildings. Later, when the Signal Service officer took charge of the disposition of the gauges, they were placed from 18 inches to 2 feet above the ground,

None are exposed upon roofs.

Mr. Redding, Georgia, said the only rule in his State is to place them on the ground. They are using gauges according to a model of his own, and perhaps a little different from those furnished by the Smithsonian Institution, but very similar to those used by the Signal Service. He thought there was very little difference in the amount of rainfall obtained in gauges on elevated places and on the surface of the ground. There might be errors in a given length of time. Rainfall in a gauge exposed on the roof at one time might give a little more than due measurement of the gauge located on the ground, or vice versa, but in the course of a year he thought the errors would correct themselves. He is careful to have no trees or buildings near the location of the gauge.

P. H. Mell, Alabama, stated that he was using the Signal Service rain-gauge, and that he had them made at the central station. He gives his observers orders to expose the rain-gauges on the ground. His gauges are placed away from trees and buildings.

Mr. Thomas, Ohio, said his gauges were located in very flat places, and not on buildings at all, and thought the elevation about 18 inches, the lower end of the gauge being placed in the ground. The gauges themselves are procured from the makers of the Sig-

nal Service instruments, the gauge being the standard.

Lieutenant Dunwoody said if the Signal Service had a perfect description of the form and dimensions of gauge to be used in the several services they might be enabled to have the gauges made at less cost than if made for individuals. The gentleman from Georgia, he believed, had designed his own gauge, and they cost him 25 cents. He would like to have him give a description of the gauge.

Mr. Redding said the price is 25 cents apiece by the dozen; the measuring scale costs cents additional. The cylinder is made of tin, 14 inches long, 2 inches interior 85 cents additional. measurement; copper funnel, 4 inches in diameter on top, with cap fitting inward; the diameter of each is exactly 4 inches. The measuring scale is made of box-wood and is 16 inches long, and does not differ materially from that furnished by the Signal Service.

Mr. Upton said when the New England service was first organized, an investigation of the subject of rain-gauges was made, and they concluded that sufficient accuracy had not been attained in the gauge itself; most of them were only approximate gauges; often those furnished by the Signal Service had large errors. The gauge in Providence had an error of 10 per cent. Perhaps the gauges were not made according to pattern. The great difficulty with the rain-gauge, as commonly constructed, is that the rim of the receiver is not perfectly true, and the only way to make the receiver perfectly circular was to turn it in a lathe. The gauges they made were of copper, and they have two kinds in use, both modeled after the style of the Signal Service gauge. One style has the measuring tube attached to the receiver, and in the other the tube is separate. The lowest cost of these gauges, made of copper, is \$4.25. We have instructed our observers using gauges of a different style to make tests of their accuracy.

Mr. Hazen thought it ought to be remembered that the error of a gauge due to its exposure was far greater than any possible error that can come from the gauge itself. He thought the cost of the gauge an important matter, as many observers may refuse to take observations because they would have to pay such large prices for the gauges. He thought gauges made of galvanized iron would give accurate results, and also if made of tin the rim might be turned and a sharp, well-defined edge, and one likely to last, would be secured. Such a gauge might be made for 75 cents, although one costing, perhaps, \$1 would be more satisfactory. He saw no reason why a tin gauge could not be

made within 4 per cent. of accuracy.

Mr. Mell was of opinion that if the edges of the rim of receiver were flared out instead of turned, very little error would be caused; have the diameter of receiver 8 inches and you could have a tin gauge as accurate as one made of copper or galvanized

Mr. Russell stated that the rain-gauge in use in the Signal Service, and which had been in use nearly a year, corresponded with the Upton gauge. The rim of this gauge is made of heavy brass, turned down to a sharp edge; the collecting tube being of drawn brass. These gauges were carefully calibrated and correction cards were sent out with each instrument. He thought cedar the best wood for making the measuring stick, it makes a clean sharp line when dipped in water. The cost of these gauges to the service is \$3.30. The sticks cost 10 cents. These gauges are made by a firm in Newark, N.J. In the matter of anemometers, we have succeeded in getting very good instruments for \$18, formerly costing \$25. The manufacturers will sell to the State services for the same

Mr. Rotch inquired whether snow-gauges were used at all in measuring snow by the

different services.

This question developed a difference of opinion in regard to the proper mode of measuring snowfall, some members being of opinion that the best plan was to measure the snow melted, while others thought better results could be obtained by measuring the snow unmelted, with a graduated stick, and estimating the depth if melted, on a scale of 1 to 10.

Mr. Upton thought that the measurement of snow in the northern districts quite difficult, and that a separate column should be added to the form used by observers for reporting precipitation, and that rainfall and snowfall should not be combined as in the present form.

At this point the discussion of rain-gauges was laid over temporarily, and the question

of location of instruments was taken up.

Mr. Upton thought that the instrument which was most difficult to locate was the thermometer. He thought there was no difficulty, as a rule, with other instruments, and would like to know how thermometers are exposed in the different services at present.

Mr. Thomas said the exposure of thermometers in the Ohio service is generally in the Signal Service shelters. There is want of uniformity, however, of surroundings. He thought this point was brought out very strongly during the last cold wave. The minimum thermometer at the Signal Service station at Columbus registered on one night minus 2°; at the university, one of the Signal Service instruments located on the east side of a house, not far from the base of a furnace chimney, registered minus 12°. The minimum thermometer at the Signal Service station at the university, exposed in the Signal Service screen, registered minus 14°. Now this fact of difference could not be due to any temperature gradient. The explanation is found in the fact that the Signal Service station lies in the center of the business portion of the city of Columbus, the screen is on the top of the building but little higher than the roofs immediately surrounding, in the track of gases coming from several smoke-stacks lying in the west and southwest, and the prevailing winds there are south and southwest. Further, not only are the thermometers strongly influenced by their position at this station, but the anemometers likewise. Take the velocity and direction of the wind as shown by the reports of the weather bureau, and you will find in our monthly summaries that when you come to compare the temperature and wind movement, there is great discrepancy between the two stations; only a half mile apart. One discrepancy in the direction of the wind is due to a fault at the university itself, owing to the location of the instrument. With respect to the wind movement the error is at the central station, for I have here now the December report of the Signal Service bureau; the record at the Signal Service station is 5,557 miles, and at the university 6,572 miles. The difference is not due to any difference in reading or care of the instruments, but is simply due to the elevations. The anemometer at the University is located on the top of a tower, 100 feet from the surface of the ground. The anemometer at the signal station is placed at much lower elevation, and the wind

currents are broken by the surrounding buildings before reaching the instruments.

Mr. Hazen said that in Professional Papers No. 18 will be found a very complete discussion of the observations at the signal office in Columbus, and at the Ohio State University. The difference in the elevations of thermometers is one of the important features. The thermometer at the university being 4 feet above the ground, and that at the signal office in the city being 80 feet. In clear weather the temperatures at the Ohio State University were three or four degrees lower than in the city, but in cloudy weather the city temperatures were lower than in the country. The trouble was not so much with the observations in the city, as there was no interference of air-currents, but with the temperatures at the university being taken only 4 feet above the ground, and conse-

quently being affected by the cooling of the air from radiation from the grass.

Mr. Payne supposed that to get the true temperature, the surface temperature is the one to know. His rule was to expose the thermometer 15 feet above the surface of the

ground, and in general not less than 12 feet.

Mr. Mell, referring to the location of the Signal-Service instruments at the cotton-region stations, stated that he had visited last year these stations located in Alabama and found that often where the observers were careful to expose their instruments in accordance with instructions—that is, on the north side of the station buildings—the observations were defective, and many errors arose on account of the proximity of box-cars and locomotives, giving out great heat. At Birmingham, Ala., he found the shelter placed on the north side of the building, but down between several railroad tracks, in the angle of three railroads, and at no time during the day were those tracks clear of cars, and the heat there during the day was much greater than at other points in the city. Very little value is placed upon observations at Birmingham for these reasons. The exposures are usually proper, and care is taken by the observers to carry out instructions, but it is utterly impossible to get accurate results from these instruments placed in the hands of railroad men. It would be best to let other persons take the observations—farmers, &c. He found, in some instances, thermometers placed 50 or 60 feet above the ground, and

placed upon the roofs of railroad buildings. At the Polytechnic Institute the instruments are exposed in a shelter located in his yard, and detached from the building, away from all radiation, and in such a position as not to allow the wind to strike the instruments at all. He gets good average results. The instruments are placed within 8 feet of the surface of the ground. He has been reading them in this position for several years, and he gets very good results.

Mr. Redding, Georgia, said that in regard to the observations at the cotton-region stations, at the time he took charge of the State weather service, he took occasion to examine some of the stations in Georgia, and the location of the instruments, and he found things just as Mr. Moll had stated, that the exposures were very poor on account of the proximity of railroad cars. He did not rely upon the observations at all, the maximum

temperatures usually being too high.

The chairman thought all this information relative to the cotton-region stations was just what the Signal Service wanted. But he thought a little explanation was due the conference regarding these particular observers. The observers are paid out of a limited appropriation at the rate of fifteen or twenty cents per day. They are necessarily located at telegraph stations, in order that they may telegraph results to the centers, so that the observations may be telegraphed to the central office in Washington and be made useful. We have now before Congress the estimates for the coming fiscal year, in which we have made an entirely new basis for this cotton-belt service, and have arranged to pay fifty cents per day to each observer in order that we may get intelligent men for

this purpose.

Mr. Mell recognized the importance of having these stations at the telegraph offices and fully appreciated the difficulties in the way of having them elsewhere. He thought the difficulty could be surmounted by getting some person away from the railroad to take the observations and carry them to the telegraph office. He thought ladies, young men, and clerks could be found who would be willing to do this. If this could be done, the cotton-belt work would be very highly appreciated by the people of the South. These observations are very necessary for the shipping of cotton. He knew a case where one observer had reported no rainfall for one month, when they had had during that time a good rainfall over the entire State: At Salem the rain-gauge is exposed between two side-tracks, and these two tracks are nearly always occupied by cars, and there is only space enough between the cars sufficient for one man to walk. He debated the question with this observer, and the observer stated that he had authority to place the gauge there by the Signal Service. He succeeded, however, in getting the observer to change the location of the gauge. The men read over the instructions very closely, but do not always place their instruments in the correct locations.

Mr. Hazen said, referring to location of shelters, that ordinarily on the north side of a building the maximum temperature will be lower than the true temperature, but it depends a great deal upon the observer and the way he follows his instructions. In Houston, Tex., it was found that the shelter had been placed upon the south side of the station. If it is not possible to place the shelter on the north side of the building, it

should be located on the northeast rather than on the northwest.

Mr. Fuertes inquired as to evaporation gauges; whether evaporation gauges are used in the different State services, and if so, what kind of gauges are used and what are the

exposures, or whether measures are taken to determine evaporation at all.

Lieutenant Dunwoody said the Signal Service had exposed a small self-recording evaporating gauge on the roof of the Signal Office in Washington, and he remembered that on a number of days during the summer the record of evaporation was about one-third inch per day. That was his impression. The curve of evaporation was very marked after 12 o'clock in the day, before that time the curve was almost horizontal. There was very little evaporation before noon, but during the latter part of the day the evaporation was very rapid.

Mr. Fuertes was of opinion that the amount of evaporation varies greatly with exposure. Evaporation is such an important element in agriculture that he thought something more ought to be done than had been done hitherto. It will be found that the percentage or difference between evaporation on the shores of marshes, in grass or in low lands, and on the tops of houses and buildings varies a great deal. The question seemed to him one of great importance and something should be done to give an impetus to the use of evaporation gauges; also to secure some uniform method of taking observations.

Lieutenant Dunwoody thought, Professor Abbe had some interesting data on the sub-

ject, and he was sorry that he was not present.

Mr. Mell suggested that the consideration of the topic under discussion be postponed for the present, and that probably the conference could hear Professor Abbe when it was resumed.

There being no objection it was so decided, and the consideration of the second topic, "Location of instruments," &c., was laid over, and the discussion of the third topic, "Form of publication of results," was taken up.

Mr. Payne suggested that inasmuch as the report of the committee on blank forms for records was not ready, that the subject be deferred until the report was received, and made a motion to that effect, which was carried, and the question was laid over accordingly.

The fourth topic, "Forms of weather signals," was the next subject in order, and

the chairman inquired whether it was the desire of the conference to take it up.

Lieutenant Dunwoody said that there was a gentleman present who had prepared an article on the subject of weather maps, and General Hazen had requested him to bring the subject to the attention of the convention, and he moved that an opportunity be given the gentleman (Mr. Noyes) to read his paper to the convention.

The motion was carried, and Mr. Noyes read the following paper:

### THE IMPROVEMENT OF OUR WEATHER SERVICE.

When our weather service was first established we had little knowledge of what was wanted. It was a new departure; it was the launching of our bark on an unknown sea.

We had no precedent to guide us. Prior to the date of the weather map the world thought it knew something about meteorology, but the map has taught us that we knew very little about this department of science; and so little was that knowledge that in a scale of ten it would not rank higher than three.

Those who have ignored that wonderful modern acquisition to science may doubt this statement, but let them turn to the old works on meteorology and see the reasons given for rain. See the pretensions of and faith in the almanac-makers in regard to the effect

of the moon, the tides, &c.

Before the age of the weather map we knew nothing of the movements of the atmosphere, and all sorts of absurd notions were held in regard to it; and to-day, no matter how intelligent the person may be, if he is ignorant of the weather map he is ignorant of the weather; for only by that illumination can we understand the wise and far-reaching laws that govern the movements of the atmosphere of our earth. It may be asked why we did not have a weather map before. For the simple reason that the possibility of the map depended upon the telegtaph; and until the telegraph had been perfected, whereby we could have reports at the same moment from over a wide expanse of country, it was not possible to have the present daily map. When first inaugurated, it is quite evident, from the map itself, that even its projectors knew not its full value; nor how to perfect it at once. It must be developed little by little. Those in charge of it must feel their way. That they did not at once give us a perfect map is not surprising; the surprising thing, however, is that they have gone on from one advanced step to another till they have given us the perfect map of to-day. And this, let it be borne in mind, has been done without the moral support of those whom it would seem should have been the first to assist in perfecting this grand system whereby we are enlightened as to the medium, the atmosphere in which we live, and but for which our globe would be as lifeless as the moon.

Knowledge of our atmosphere is what the map has given us.

As to the perfection of the present system, it is, as far as the principle is concerned,

as perfect as can be. The only thing now to do is to extend the principle.

The great advantage we in the United States have is our extent of territory—a double square of about 1,500 miles north and south by about 3,000 miles east and west—all under one government. One thing in this department has been well established, and that is that we cannot study meteorology in a small territory; therefore the absurdity of the local meteorological societies. They are all confined to a small extent of territory; might as well attempt to study the tidal system of the world in a mill-pond, as to attempt to study meteorology entirely in a country of small area. If one doubts this, let him follow up the weather map even for a few weeks and notice the movements of the atmosphere thereon recorded. These movements will at once be seen to be on a large scale.

The perfection of meteorology depends upon the reports whereby the map is formed; simultaneous reports, three times a day at least, sent in to headquarters, where they are tabulated and a map printed therefrom. By the map we have discovered that the general movement of the atmosphere is from the west toward the east, or toward the

rising sun.

The atmosphere is divided into two grand factors, high and low barometer, technically, for short, termed "high" and "low." These move around the world, from the west towards the east; not, however, on regular lines. We see them appear in the west—cross the country—and disappear in the east. We track them across the ocean; they are all the while appearing in the west, and, so far as we can trace them, disappearing in the east. We cannot at present prove that they travel around the world, but we infer that they do; and we have not the least doubt but what the future will prove this. Now, as these factors, "high" and "low," thus move, it follows that the more stations we have

the better, and that the stations in the west are more important than those in the east. We want stations, however, all over the country, and we may say all over the world. The more we have the better. In the East there are many stations within fifty miles of each other. Ont West they are three and five hundred miles apart. Then, again, the telegraph communications in the far West are frequently interrupted, so that practically

the distance between stations becomes much greater.

The "lows," which seem to be the governing scature, may be said to enter the United States at four general points—the extreme Northwest, in the neighborhood of Washington Territory; the Southwest, or near the head of the Gulf of California; through Central Mexico, Texas, and the Gulf; and occasionally from the West Indies. Therefore, we want more stations in these several directions-more in the far Northwest and Southwest, some through Mexico, and even the Gulf, and a few in the West Indies. dition to the one at Havana, one on the extreme eastern end of the island of Cuba, and one farther north on the islands of Bermuda. The storms that come from the southeast quarter may seem to counteract the law that the movement of the atmosphere is from the west toward the east. If we will refer to the map, we will see that although this is a general law, the movement is, at times, even for a great distance, almost due north or due south, and occasionally even toward the west. But whatever the local or special movement may be, the general movement is as herein stated. When it is otherwise, it is only for a short time, and sooner or later the easterly movement is resumed. From the inequality of the surface, the direction of these forces on land are very irregular, while on the ocean, where there are no counteracting influences, such as combinations of land and water, mountain-chains, plains, &c., the direction or course is very regular-We need a few stations in our South and East, in order to be forealmost due east. warned of these "lows" that occasionally, more particularly during the late summer

months, at present come so suddenly upon us from that quarter.

The next point I would offer is the "skeleton-map" idea. The present map is most valuable as a scientific instructor and for practical purposes near at hand, but we know that the mail cannot deliver one of these maps farther away than about 500 miles in twenty-four hours. Then, sending the map to the West is sending it toward the approaching movement, whereby the time is still further reduced. We could have a number of centers where a map could be printed and issued, but this would be expensive and unsatisfactory. In addition to the map now published at Washington let us adopt the "skeleton-map" system. Let the map of the United States and surrounding country, as much as we can cover by stations, be divided into squares, on lines of latitude and longitude. As to the size of these subdivisions, let that be determined by the practical tests. Squares not too large or too small. I think about seven or ten squares in length, from west to east, and the same proportion from south to north, would be a very good size. Say, have the squares numbered and the intersecting lines lettered, or the reverse. This would give us a very simple and convenient system. Throughout the country, in every office and household, they can have their "skeleton map" suspended on the wall, say beside the calendar; and even smaller editions can be published in the columns of our daily papers. In place of or auxiliary to the present plan, let the central office telegraph all over the country the location of the "highs" and "lows," even three times a day; and in addition, at the post-offices or newspaper offices, let there be large black-

boards with the skeleton map thereon in plain white lines.

As the report is received some handy person with a piece of chalk can step up to the board-map and thereon make a few lines—indicate the "high" and the "low." The public will soon learn to read it; and when they do, they have something valuable. Then they are not only obtaining some local information valuable to them for the next few hours, but, as it were, they are taking in the scope of the whole country, and know what conditions prevail where their friendly or business interests may be, even thousands of miles away, and, in addition to this, they are the while receiving practical instructions in meteorology. No longer will they be imposed upon by the many erroneous sayings that are so common about the weather, and as for the so-called "weather prophets," their silly vocation will be at an end. The world will have light and not darkness to guide them, and they will soon grasp it and realize the glorious scientific revolution that has been wrought by that wonderful illuminator, the weather map.

ISAAC P. NOYES.

WASHINGTON, D. C., February 23, 1886.

The consideration of the fourth topic was then taken up.

Lieutenant Dunwoody said he would like to know the different plans under this head that have been used in the several services, and would like to hear their merits and demerits discussed, as he thought this was a means of enabling the Signal Service to utilize the State weather services, and with their co-operation an opportunity would be given the Signal Service for intercourse with the people.

Mr. Davis said he would like to hear from Ohio first on this matter, as he believed the

first formal plan of weather signals originated there under the direction of the chairman, Professor Mendenhall. He was sorry that he was not able to approve of the Ohio plan. He thought there ought to be something more simple than the six or seven flag system. He thought the number of signals now displayed very small to what should be displayed.

Mr. Thomas presumed the members of the conference were quite familiar with the system of signals in use in Ohio, as they are the signals which have been adopted by the Signal Service. (Mr. Thomas exhibited cards showing the signals, and said that the cold-wave signal would be printed on the next supply.) He could not give precise information as to the extent to which these signals are used, because there were a number of private parties who have provided themselves with flags and display the signals from information obtained in the morning newspapers, from railroad offices, and from the Signal Service stations. There has been great activity in Ohio in the past six months in this There are ten stations named by the bureau as the recipients of special-prerespect. The Signal Service had asked his service to aid them in designatdiction telegrams. ing the persons at these points who should receive these telegrams. In certain cases some of the corporate bodies of cities, towns, and villages have directed different local officers-in some cases the fire departments, police departments, and kindred organizations—to attend to the receipt of these telegrams, and made it a part of their regular duties to display these flags upon some prominent point in the cities or towns. A number of private business firms are using the signals, and display them as little signs on the fronts of their places of business. The general method of display is that of a flag from a flag-staff. In Columbus the bureau has displayed the signals after the manner of banners on a rope across the street; but in these cases the flags are soon worn out by the wind, and the practice has been discontinued. As to the simplicity of the signals, he did not think it necessary to simplify the system at all, as school children understand exactly what is meant by the signals. He did not think the system is at all objectionable upon the score of complexity or difficulty of the people to understand it. described the manner in which these signals were displayed on the sides of baggage cars on some of the railroads in Ohio. These signals are quite popular in the region through which the trains pass, but people at a distance from the roads would like to have audible signals. Some of the factories have undertaken to whistle the signals, but with what success he did not know.

Mr. Davis said that in New England they took up the Ohio system of flags on the recommendation of the Signal Service. They have a certain number of telegrams allowed them by the Signal Service, and the information is sent by telegraph or telephone to the different New England stations and to persons who agree to display the flags. In that way a small number of people is reached. One of the difficulties in the way of getting

people to display these signals is the cost of the flags, which is \$8.50 per set.

The New England service has a scheme for the State to take up the matter of the distribution of messages to all telephone exchanges, the exchanges agreeing to send two a day to local points, and he thought if the States took this matter up it was very important to adopt a permanent system of signals before it was done. In order to have the system succeed it would be very important to have the States pay for the flags. The expenses of the service could be diminished one-half in that way. The number of flags could be reduced. He would indicate higher and lower temperature by the attitude of the temperature flag, and thought that the local and general rains could be embraced in one flag. He would not have a flag for stationary temperature, but would have a fair-weather flag. There should be a little streamer to indicate the beginning of the signals, so that the signals could be read when displayed horizontally. He would like to see some simplification of these signals in this way: Temperature indicated by one flag, stationary temperature flag omitted, and, if possible, local and general rains indicated by a single flag. Then there should be a change in the time of receipt of the indications. He thought the matter could be greatly aided if they could get the indications for to-morrow, say, at noon to-day, disregarding the weather He thought too much attention was given to the actual weather in for the afternoon. the indication and not enough to anticipated weather. Referring to the form of weather signals, he suggested that it is not necessary to have any figure or symbol on the flag, but simply to have a red flag to designate temperature and the blue flag for rain, and, in case the flags are hung horizontally, have a little streamer to indicate the beginning of the signal and spaces to show "followed by."

Mr. Mell said it was not his intention when he adopted the signals in use in Alabama to run in opposition to the Ohio system. He took charge of the Alabama weather service after Professor Mendenhall established the system in Ohio, and he made an attempt to use the Ohio system in his State. It is very well to expose the signals on railroad trains, but it is better to have them displayed at the stations. He had been greatly aided in his system by the different railroad companies in his State. One road not only telegraphed the signals, but bought the flags and put them up. Some of the roads objected to using the red flag because it was their danger signal, and would therefore be confus-

ing to their railroad employés. For this reason he had adopted the orange color. (Mr. Mell here exhibited a set of his flags, and explained at length his system of signals.)

He used a square white flag for fair weather, square orange flag for local rains, and square blue flag for general rain, a triangular-shaped black flag for temperature. On some of the roads he was required to get parties to take charge of the signals. Referring to the Ohio system, he said that he found difficulty in reading the flags when they hung close to the staff; he could not tell whether it was the moon or the star. His flags were made of calico, owing to its durability and cheapness. A set of the flags coet \$2. He had found newspapers that published his symbols without the colors, but with description of each printed thereon. He had found difficulty in convincing the Western Union Telegraph Company that his system was a good thing and that they should send these signals free. The company had uniformly declined to aid in the cause. In preparing his system he found the thing to be secured was simplicity, something that the people could easily understand, and he believed his system attained this object. He thought the flag for general rains might be done away with, and this would leave three flags. He had printed the cold-wave flag on his card for the convenience of the people with whom it was popular. The cold-wave flag had been displayed from the college building, and could be seen at a great distance.

Mr. Upton inquired why the peculiar shape of the temperature flag had been adopted. Mr. Mell could not give any special reason for the triangular shape of this flag. It had been decided upon for no particular reason. For "followed by" he leaves the space

of one flag between the signals.

Mr. Davis said he had been able to do but very little with railroads in New England, with the exception of the Old Colony Railroad Company, which displayed the signals on

its trains.

Mr. Mell thought his system the best that could be devised as to simplicity. He explained that in telegraphing the indications—say, fair weather, higher temperature—he would simply say "white below black." The railroad superintendent receiving this telegram would put it into his dispatcher's hands, and the dispatcher telegraphs the same wording over his lines to the agents. Time is a very important item; these signals must be sent out promptly or they would be of no service at all. The telegraph

companies are not always prompt about this matter.

Mr. Thomas stated that no recommendation had been made with reference to a system of whistling signals in Ohio. Some parties had taken the matter up, but he had not been advised in regard to the method of signals. Efforts were made to induce the rail-road companies to whistle these signals, but they declined, as it would confuse their own signals. The Ohio system had become largely used, yet those who are connected with that system are not so firmly attached to it that they would be unwilling to adopt any good uniform system of signals that the conference might decide upon. There was another point in connection with the topic under discussion which he would like to refer to, and that was a rule of the Western Union Telegraph Company not to give to any person, except the one addressed, the contents of any message sent over their lines. He thought that by joint action of the conference and the Signal Service this rule might be modified as far as related to these weather telegrams.

Mr. Mell explained how the railroad telegraph operators signaled to attract the attention of the operators along the lines, after the manner of the time signals, and then

began sending the weather signals.

Mr. Thomas said that the train-dispatchers of the several roads in Ohio sent out the predictions in the morning, and sometimes used the figure 3 to call the attention of the

operators.

The chairman (Professor Mendenhall) questioned whether the conference was ready for action on the question under consideration. The matter of the display of signals was one of great importance. He explained that when the Ohio system was first originated it was not intended to be a universal system. The question of form, of color, and of position were all to be considered, and the most desirable should be selected. The emblems, sun, moon, and star, were designated primarily for use on the sides of cars, and not for hanging flags. Various forms of flags, consisting of solid colors, were experimented with at the time of the conception of the Ohio system, and the result was the adoption of the sun, moon, and star. Professor Mell's signals involve position, and there is great difficulty in this element. Referring to the drum signals, he said that they had form and position both, and thought they possessed many advantages over the flag system. One difficulty with the flag system was that they could not be seen in a great plain. He saw only one reason for immediate action on this question, and that was that by and by we shall have great difficulty in making any change in the system after thousands of the present signals have been scattered over the country. He did not think the conference was ready to vote the adoption or make a recommendation of any particular system of weather signals, and suggested that it would be more advisable to appoint a committee of members of this conference to consider the different systems of signals in use and

to accept suggestions in the matter during the next six months; and after carefally con-

sidering the whole matter, the committee could make its report.

Mr. Davis objected to a long postponement. The chances were that the State of Massachusetts would take up the system of weather signals, and that by the early summer, if at all, and if such action was taken by the State his service would have to use the system that is now in use or one that might not meet with approval.

Mr. Upton said that the action that he was about to suggest was that a committee be appointed to consider the question, and that it be directed to report progress, at least,

Mr. Fuertes stated that he had no favorite system. Described a system in use in New York by means of a mast, provided with yard-arms, from which the signals are indicated by combinations of balls.

Mr. Thomas moved that a committee of five be appointed to consider the question of a uniform system of weather signals and to receive suggestions in this connection, and to report progress to this conference to-morrow afternoon.

The motion was adopted, and the chair appointed Professors Davis, Thomas, and Mell,

and Lieutenants Dunwoody and Woodruff as the committee.

The conference then adjourned until Thursday morning at 10 o'clock.

NATIONAL MUSEUM, WASHINGTON, D. C. Thursday, February 25, 1886.

The conference was called to order by the chairman (Professor Mendenhall) at 10 o'clock a. m.

The discussion of the third topic: "Location of instruments, especially of rain-gauges," was resumed as unfinished business.

Mr. Mell offered the following motion as the opinion of the conference regarding the exposure of rain-gauges.

That the collecting edge of the rain-gauges shall be exposed as nearly as practicable about 12 inches above the surface of the ground, to be in open ground if possible, and

not nearer any object than twice the height of that object.

Mr. Gillingham, Virginia, inquired what the advantage was in having the gauge so near the ground. He thought the rain-gauge should be protected from the interference of children, stock, &c., and that this protection could not be had if the gauge were placed on the ground. He thought the gauge ought to be elevated in order to be out of harm's way. His gauge was exposed about 6 feet above the ground on a post, in an open space.

Mr. Upton explained why the New England service had adopted the ground exposure. They had done it for two reasons. They desired, first, to get the rain that actually falls on the ground, and they only wanted to place the top of the gauge high enough to escape spattering. Others had dug into the ground and placed the gauge with the top of The other reason the instrument protected by a ditch to protect it from spattering. was that in locating the instrument on the ground they accorded with the plan used in England. There are 4,000 gauges in use there, and the rule there is very rigid. Lieutenant Dunwoody said that the Signal Service exposed many of its gauges on the roof, not because it had been determined that roof-exposure was the best, but because the Service had practical duties which required its observers to be located in commercial centers, and for that reason it was usually unable to have the rain-gauges exposed on the ground. The observers are necessarily compelled to make their observations at the station offices that they may be promptly telegraphed to the central office, so that it is not always possible for the Service to select a point for the exposure of its rain-gauge on the ground. They may at some time be able to secure reports from observers outside of cities, and these would be preferable to those taken in the centers of cities. marks were made that the conference might understand that although the Signal Service rain-gauges were exposed upon the roof, yet it was not to be considered that the service preferred this exposure.

Mr. Rotch suggested that a great objection to roof-exposure of rain-gauge was the action of the wind on the rain. Experiments had shown that there was decrease of rainfall nearly two-thirds at a distance of 60 feet above the ground. He did not know

whether that difference was attributable to the wind or not.

Mr. Mell said one reason for locating the gauge one foot above the ground was the fact that the New England service had tried this plan in a general way and had arrived at very satisfactory results. The New England service had recommended this matter to the different services. It has been adopted there, and there is no other regular method in the country. It would be easier to have the different sections of the country adopt a system that has proved satisfactory than to have these gentlemen in New England adopt a new system. He had not recommended any particular exposure, because he had, in experimenting, found that there was a material difference between the two positions.

He had not recommended a change because the Signal Service was using a different location. He thought it would be preferable to adopt the height of 1 foot for the reasons stated.

Mr. McAdie thought there should be a fence round the gauge to prevent interference

by outsiders.

The chairman thought there should be some such protection to the rain-gauge. was no difference in results between rain-gauges exposed 6 feet and 1 foot above the ground.

Mr. Mell's motion, modified to read as follows, was adopted:

That the conference recommends that whenever practicable, rain-gauges be placed with the collecting edge one foot above the ground and that it stand at least as far from adjacent objects, such as trees, buildings, &c., as twice the height of these objects; and that the conference disapproved of roof-exposures.

The form of rain-gauge to be used by the several services was next considered.

Mr. Mell thought the conference might adopt the gauge that is now in use by the Signal Service, and change it to some extent to adapt it to their purposes. He did not like the edge at the mouth of that gauge, and thought some error might be avoided by changing it somewhat; he would flare the edge out.

The chair stated that the present gauge does not have the beaded edge. A new form

of gauge has been adopted, and it is entirely free from that objection.

Mr. Thomas said that the Ohio weather service is using the Signal Service gauges, and

made the following motion:

That the form of rain-gauge now made by the Signal Service and in use by the Ohio State weather service be adopted as the standard rain-gauge, and that the several State weather services be asked to adopt this gauge as far as practicable.

Mr. Mell would like to have a gauge with a sharp, well-defined edge.

Mr. Upton said there was a slight difference between the gauges used in the New England service and those used by the Signal Service. Some of the gauges have the tube entirely separated from the gauge. Certain observers like to take the gauge into the house and pour the water into the measuring tube.

Mr. Redding stated that he had difficulty in sending his rain-gauges through the mail

to his stations on account of the edges being broken.

The Chair stated that the Signal Service gauge was made by contract with the lowest bidder, and the cost had varied from \$3.40 apiece for the first 100 gauges to \$3.30 for the last lot made. If the conference decided to recommend this gauge, they could probably be obtained here in Washington by the Signal Service cheaper than they could be bought The gauge now used was the result of long investigation by the officers by individuals. of the Signal Service.

Mr. Upton thought the conference would be safe in adopting the result of this inves-The Signal Service gauge accorded with similar experiments made in other

Lieutenant Woodruff said the new Signal Service gauge was made as far as possible according to a standard, and the old gauges on hand were altered to agree with the standard. It was concluded that if those bodies which wished to make observations could approach as nearly as possible to the standard in some cheaper material as far as possible, the Signal Service would replace the old gauge with a proper standard gauge or the nearest approach to that standard.

Mr. Upton inquired whether the Signal Service would sell the smaller gauge (3 inch)

which was on the list for \$1.50?

The Chair stated that he thought not.

Lieutenant Dunwoody said a smaller gauge was made for sending by mail to meet the

demands of the Post-Office Department.

The object of this standard was to secure a gauge that would give good results. In making experiments with these gauges at Fort Myer, for the purpose of securing a standard, it was found that there was but very little difference in results between the smaller and larger gauges. The smaller gauge caught more water, but very slightly, not more than one or two per cent. This increase of rainfall as shown by the small gauge was attributed to the fact that the rim of the small gauge was sharp, and the rim of the larger one was turned. A gauge should be made with the rim of the funnel sufficiently rigid to prevent jamming and to secure a uniformly circular opening at the top.

Mr. Thomas's motion, modified to read as follows, was adopted:

That the Signal Service rain-gauge be accepted as a standard, and all State weather services be recommended to approximate it as nearly as possible.

A member inquired as to the proper time of reading rain-gauge, whether at fixed hours

during a storm or at the end of the rain.

Mr. Russell said 7 a. m., 3 p. m., and 11 p. m., were the hours in the Signal Service, irrespective of the duration of the storm.

Mr. Upton said it was the custom in the New England service for the observers to read their gauges after the storm has ceased, and to look at it in the morning; or if they wished to read it at stated hours they could do so.

The conference then proceeded to consider the fifth topic, "Scale for estimating wind

velocities."

Mr. Fuertes thought the conference should adopt the decimal scale for estimating wind

Mr. Hazen said the decimal scale for estimating wind velocity as far as it was concerned was good enough, but it would be much better to use half the Beaufort scale of 0 to 12, as recommended by some. With a scale of 0 to 6 he thought there would be no difficulty in estimating wind velocity. He explained that force I would just move the leaves of trees; force 2 would move small branches; force 3, larger branches of trees, &c.

Mr. Davis said that in regard to the use of a long scale, that is, a scale of more than

5 or 6, he was in favor of the smaller scale for voluntary observers.

Mr. Houston, of Indiana, urged his observers to be very careful in estimating and reporting velocities of wind. One of his observers had sent in a record of 60 miles per hour on one occasion, which was very much more than the actual velocity at the time. He did not know, however, whether this was the fault of the long scale or not.

Mr. Mell stated that what is needed is something that ordinary observers will under-He had found the same difficulty with his observers that Mr. Houston referred to.

Lieutenant Dunwoody said that it seemed to him that the object of estimating these wind velocities could be attained by using the ordinary terms in the Signal Service reports, for instance, in Instructions to Voluntary Observers the scale given for the use of those who do not have an anemometer with which to measure the wind, the scale is indicated by the words, "calm," "light," "gentle," "fresh," "gale," &c. He could not see why these instructions could not be used on the blanks furnished. Instead of converting the terms "calm," "light," &c., to figures, why cannot you write on the blanks these terms, and let the observer use his judgment, and we would know at once what the measured velocity was.

Mr. Rotch believed that uniformity could be secured by the use of pressure plates.

They could be made at little cost.

Mr. Hazen said that in recommending a new scale to be adopted by voluntary observers it is not necessary to use the figures, but the words could be used as suggested by Lieutenant Dunwoody, and offered the following motion:

That the conference adopt the scale of 0 to 6 for measuring wind velocities, in place

of the present scale of 0 to 10.

The motion was seconded.

Mr. Fuertes moved to amend by making the scale 0 to 5.

Mr. Davis inquired whether Signal Service instructions would be modified in case a change was made by the conference in the scale. He preferred to take no action that would differ from those instructions.

Mr. Mell thought it would be better to leave it to the committee to confer with the

Signal Service authorities.

Mr. Thomas said the discussion had developed the fact that there was no uniformity of opinion in this matter, and thought some simple expedient, as suggested by Mr. Rotch. might be used. It would be better to defer the whole question until another meeting of the conference, and moved to lay Mr. Hazen's motion on the table.

The motion to lay the motion of Mr. Hazen on the table was adopted.

The conference then reached the sixth topic, "The possibility of term-day observations, as suggested in the American Meteorological Journal, page 155, 1884."

Lientenant Dunwoody moved that the Committee on Forms be directed to make its

report, and that no discussion of the report be had until the afternoon session. Lieutenant Dunwoody's motion was agreed to, and Mr. Upton read the report of the

Committee on Forms.

Mr. Houston moved that the Committee on Signals be directed to make its report of progress, and that the discussion of same be deferred until the afternoon.

Mr. Houston's motion was adopted, and the report of progress of the Committee on Signals was read by Lieutenant Woodruff.

The conference then adjourned until 1.30 p. m., same day.

## AFTERNOON SESSION, FEBRUARY 25, 1886.

The conference met at 1.30 p. m., pursuant to adjournment. Professor Mendenhall in the chair.

The chairman stated that the next business in order was the consideration of the sixth topic, "The possibilities of term-days as suggested by the American Meteorological Journal," which had been temporarily laid over at the morning session. The chair suggested that the secretary was able to state the sense of this proposition, and he thought it advisable for him to do so, that the configure might understand the meaning of the

suggestion.

Mr. Davis said the question involved the addition of something to the work of the services. He explained that the deficiency of observations on local storms which made the determination of their action doubtful, might be remedied by appointing special days on which hourly or tri-hourly observations should be taken, with additional records at still more frequent intervals when any change in the atmosphere required it. These special days might be on certain prearranged dates, "term-days," when the records would gather up everything that happened to come along in the passage of the weather; but they would better serve the purpose if they were specially appointed by the Chief Signal Officer only a day or two before their date. For instance, in the event of tornadees it would be well to have observations during the storms at other places where they are not possible. The plan could be published in advance by circulars and newspaper paragraphs, and then, if while a cyclone was still beyond the Rocky Mountains, the day of its arrival over the upper lakes could be forefold, and there might be thirty to sixty hours' telegraphic notice given by the appointment of such a day for special observations over the whole region east of the Mississippi River. It might be possible to have the discussion of the results of these observations carried on by the local services, and have a tabulated statement sent on to the central office for investigation and study. He thought the accumulation of simple matters of fact as to the general condition of the weather over a large area by many observers had at a time when somewhere in that area more or less meteorological disturbances would take place, would prove of interest.

Mr. Upton believed that Mr. Davis had suggested a very important subject for investigation. The question comes up, what can we do as a conference in the matter of tak-If the general weather service wished to engage in this investigation, let the Chief Signal Officer make arrangements to inform the different services of these different term-days. It was to be hoped that the chiefs of the various services in different parts of the country would take sufficient interest in the subject to make the observa-tions. He thought, however, as a conference they could not act upon it.

The chair thought the conference might go so far as to request the Chief Signal Officer to furnish necessary information and plans to the directors of the weather services, when desired so to do. The conference might officially recognize the question to that extent.

Mr. Davis said that so far as the work was concerned in New England, he would be very glad if the conference would aid them to that extent. It is a question rather different from the others to be considered by the conference, and his chief desire was to suggest to the services here represented the consideration of this style of study, and he would like to have the support of the conference in getting from the Chief Signal Officer notification of the term-days, say on the day previous.

Professor Abbe said the object sought to be accomplished was a very desirable one. The notification of the term-day by the Chief Signal Officer could be published in the There could be little objection to that. It is not worth while to send a

telegram unless the service is ready to make the observation.

Lieutenant Dunwoody stated that notification by telegraph could be readily given by the Chief Signal Officer to the chiefs of the different State services for special observation. The notification for term-days could be added to the ordinary dispatches containing the indications which are now sent. The preliminary arrangements might be made by the The observers could be notified by postal-card from the State centers. warning might be given two days in advance, and it could reach the observers within twenty-four hours, so that the plan might be begun with the single expense of telegraphing to the chiefs. For instance, a storm might be approaching from the extreme Rocky Mountain region; the Signal Office could notify Mr. Davis in New England that two days from that date it would be desirable to make these observations. dicated in a single telegram to Mr. Davis that the weather conditions seem to indicate that within two days a storm would reach New England.

Mr. Davis thought the plan could be inaugurated without definite action by the conference.

The chair said if there was no further desire to discuss the subject, and if there was no objection, he would consider the discussion of the subject closed without action.

The conference then considered the seventh topic, "Increase of thunder-storm observations."

Lieutenant Dunwoody said he would like to suggest the consideration of a subject, which seemed to him very important, and that is the form of State weather-service organization. There was a want of harmony in the form of organization. A year ago an effort was made to have the different State legislatures organize these services by a legislative act, but there was a great diversity of plans suggested, and almost all of them differed from each other. Some were in such form as to be generally commended, while others were at once condemned by others who opposed the system. He thought if a general plan of organization could be formulated, it would be of advantage to the services by securing co-operation or an extension of the services to the several States. What is wanted is an increase in the number of services. Anything that would secure an increase of these services is for the benefit of the country at large and the Signal Service.

The Chair asked Lieutenant Dunwoody to write out his plan, and stated that the subject before the conference was the seventh topic: "Increase of Thunder-storms Observa-

tions."

Mr. Hazen said he had spent much time in the last two years in the study of thunderstorms, and his experience had developed certain principles that it might be well to present to the conference: First, too much ground should not be covered. This had been
his experience. It is necessary to have a large number of observations over a small
field, and to study there before we go over a larger field. He thought it very important
that the State services take up the matter for themselves. The stations of observations
should not be more than 4 miles apart to give the best results. Another point is the
observation of rainfall and electricity. Another line of investigation has been proposed
during the present year, and that is, when a storm of great violence occurs, special requests be sent out for reports. The concentration of this work in different parts of the
country is the most important thing at the present time. The present form of report

is very simple, and school children could make the observations if necessary.

Mr. Davis thought the question was in the same attitude as the previous one. It belongs to those services who desire to take it up. In regard to the style of the work, there were one or two points he would like to add to what Mr. Hazen had said. Instead of having a uniform plan of record, he thought that the work asked for should be graded. In that way they should be able to gather in something. They should not restrict the observations from those persons who could do a great deal more. There should be a series of forms for the purpose of gathering the reports. He thought the omission of the temperature records left out a very important element in the thunderstorm. There is a lack of cohesion in the observations. The direction of the wind is to be taken at some time, but just when is not stated. He would have two classes of observers, called respectively class A and class B. One class would make observations every half hour during the storm, when all the elements should be observed. The other class could take notes of beginning and ending of thunder, &c. In that way correlate the observations and in that way they could secure material for making synchronous maps of thunder-storms, similar to those made out by the Signal Service for larger storms. The work would be considerable, but if the State desired to undertake it, the observations might be taken, discussed, and studied, and then turned over to the Signal Office. There would be two kinds of cards used in this plan, one for thunder data; the other for rain and wind. Mr. Davis explained by illustration on the black-board his proposed plan of making thunder-storm observations.

The Chair stated if there was no further discussion under this head and no action

suggested, the consideration of this topic would be closed.

There being no objection it was so ordered.

The Chair stated that the seventh topic was the last of the questions laid down for consideration, but that several subjects had been handed him by members of the conference for discussion, and he desired to know the wish of the meeting regarding their consideration at this time.

Mr. Houston suggested that it would be well to continue the discussion of the reports of the committee on signals, and that on forms, which had been read at the morning session. He thought the questions referred to by the Chair would cause considerable discussion, and he thought the questions of signals and forms very important and they should be considered first.

The Chair stated that the third regular topic, "Form of publication of results," which was one of considerable importance, was laid over for consideration in order that the re-

port of the committee on forms might be heard.

Mr. Davis said that perhaps the difficulty in considering the matter is that sufficient funds are not in the hands of the service to do what they would like. In many observations of the State services the dates of reports are given, but not the hours. It would be a great advantage to have the hours. He did not like to make a motion that the hours of making the reports should be given.

The Chair stated that some one should make the motion on account of its importance. An arrangement will be made in the new form for having reports of times of special meteorological phenomena. If there was no desire to take any action with regard to the third topic, and if there was no objection, the consideration of this topic would be

declared closed.

There being no objection it was so ordered. The Chair stated that the report of the committee on signals contained certain recommendations which should be acted upon by the conference, and desired to know whether the conference was ready to act upon

He hoped the committee would be continued, and thought the Chief Signal Officer would be glad to have its advice in this matter. It should be continued as the representative of the conference in this work.

Mr. Upton moved that the recommendations of the committee on signals be adopted.

The recommendations of the committee as read were adopted.

The Chair inquired if there was any further action to be taken with regard to the committee on signals.

Mr. Houston moved that the committee on weather signals be continued until it is discharged by the conference.

The motion was adopted.

Lieutenant Dunwoody suggested that some means should be taken for the publication of the report of the committee. He would like to have the authority of the conference, should the committee determine to make its report after the adjournment, to include the report in the proceedings of the conference.

The Chair thought a motion to this effect should be made.

Mr. Mell inquired to whom the committee was to report.

Mr. Thomas thought the question of the time of report of the committee's report was somewhat mixed.

The Chair suggested that if another meeting of the conference could be provided for, the committee could make its report at that meeting.

Mr. Mell moved that the conference resolve itself into a permanent organization, that the work of the organization be in meteorology, and that the sessions be called at any time.

The Chair ruled this motion out of order, another question being before the conference. Mr. Fuertes moved that the question of the report of the committee on weather sig-

mals be laid on the table, and the subject of permanent organization of the conference be taken up.

Mr. Fuertes's motion was agreed to.

Mr. Mell moved that the conference resolve itself into a permanent organization, for the purpose of advancement in meteorological knowledge.

Mr. Mell's motion was adopted, and the Chair stated that it had been decided to organ-

ize the conference into a permanent body.

Mr. Fuertes moved that a committee of five be appointed, of which the present chairman of this conference shall be chairman, and on which the officers of the Signal Service shall be fully represented, to consider and report, at some future time, a plan of permanent organization of the conference.

Mr. Fuertes's motion was adopted.

The chairman inquired how the committee was to be appointed.

Mr. Mell suggested by the Chair.

The Chair said that he would rather have the conference name the members of the com-

mittee, and deferred the appointment for the time.

The conference then took up the question regarding the report of the committee on weather signals, which had been laid on the table.

The Chair inquired what further instruction the conference desired to give the committee on the subject of its report or any other subject connected with its work. Mr. Upton thought it important that when the committee had agreed upon the sig-

mals, the system should be put into operation without delay. The committee could report to the Chief Signal Officer, and the Signal Office could inform the chiefs of the various State services of the results.

Mr. Davis believed that the plan suggested by Mr. Upton would accomplish the end

desired. It would not do to wait until the next meeting.

Mr. Thomas said that it seemed to him that the matter of weather signals would be in the future a very important one, and it was a question which should not be decided upon finally without a full and free discussion upon the part of those concerned. For that reason he felt loath to propose as final action the conclusions of the committee unless they were reached after a meeting of the committee and not by simple correspondence. In view of the importance of the subject, he felt that it would be quite desirable that there should be a full meeting of the association on that one topic, and the meeting could be arranged for at the close of the spring work, say in June. There were other services, not represented at the meeting, who might come at a second meeting.

Mr. Mell thought a satisfactory result could be reached by taking the various signals and making experimental tests. He thought the matter had resolved itself simply into the questions: Which signals are the simplest; which are the cheapest; which can be seen with most distinctness, and understood by the people, and that was all. The question which this committee will have to consider, was which one of the systems of signals was the best. That action could be accomplished by the committee within a few weeks

at least, and there was no necessity for deferring action until a later session.

Mr. Davis said it was suggested that there might be difficulty on account of certain services not understanding what the report of the committee would be. One of the points that must be reached was the agreement of all the services to use the signals to be adopted. He moved that the committee be instructed to report to the Chief Signal Officer when they have agreed upon a plan of signals, and this plan be adopted by the conference.

The Chair said it should be remembered that the Chief Signal Officer would event-

ually decide this question, and the committee could be an advisory one.

Mr. Upton believed that the committee had virtually full powers already, and if it be requested to report at a future meeting of the conference, the latter would accept the report.

Mr. Houston said in regard to the convention accepting this report that it did not imply that they must accept the system of signals and use them as reported upon by the com-

Thinks the report should be qualified as far as practicable.

The Chair said the committee was appointed to consider certain recommendations and

make a report of the result to the Chief Signal Officer.

Mr. Davis thought that meant that the committee had full powers. It meant that the conference would trust the committee to do something which the former would in-This committee was to co-operate with the Chief Signal Officer in the study of this question and when it has reached a result it is to report the conclusions to the Chief Signal Officer. As he understood it, the action of the conference could only be

Mr. Thomas said the acceptance of this report embraced one action which the conference ought to take. As it was, he thought it not at all unlikely that a system of signals which might be used by the Chief Signal Officer, might be different from that used by the different State weather services in their own individual display, and it seemed to him very desirable that there should be uniformity in the signals throughout the country. The committee should make its report as simply the recommendation of the com-

mittee.

Mr. Davis withdrew his first motion, and offered the following in its place:

That the committee on weather signals be instructed to report to the Chief Signal Officer the results of its investigations and the recommendations which it has to make.

There being no further discussion, the motion was passed.

The Chair stated that this disposed of the regular order of business, and desired to know the will of the conference regarding certain subjects handed him by members, to

which he before referred.

He said he had three questions on his table for consideration. Two of these subjects related to the State weather services. One was, "What is the best form of organization for State weather services?" and the other, "Consideration of the relation of voluntary observers to the Signal Service and to the State weather services in States where local services are established."

Mr. Upton moved that the conference consider the general question of the best form of organization for State weather services.

There being no objection, this question was taken up.

Mr. Davis said he would like to call attention to the difference between the State services and the New England Meteorological Society. The State services as a rule did not intend to discuss meteorological matters or make investigations beyond the matters of observation and tabulation. The New England association had a constitution, officers, &c., and a staff of observers scattered over the State. The object was the study of atmospheric phenomena in New England. It welcomes to membership all persons interested in meteorology, whether they took observations or not. It published its own bulletin containing its records, and the society co-operated with the Signal Service in publishing its results and predictions. It had no State aid; it was supported by the fees of its membership and certain funds which the organization had been fortunate enough The organization hoped to secure State recognition. The matter of investigation and discussion of meteorological data should be considered as well as the taking of observations.

With regard to the last point suggested the chairman spoke as follows: It occurred to him that there might be difficulty in securing State appropriations to a society. appropriation to a State system or a bureau was one thing, and an appropriation to a society engaged in purely scientific work was another. In his own State he knew that while several societies labored hard to procure appropriations from the legislature they have always failed.

Mr. Davis said they had the difficulty of having to meet several legislatures. have had boards of health or agriculture, and in combining with those boards, by the

society virtually giving its work to the State, they got some support in return.

Lieutenant Dunwoody stated that he had had some experience in endeavoring to se-

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cure the organization of State weather services, and several bills had been presented to various legislatures, and although they had considerable hope when they presented them. all the bills failed. The State legislatures could not be depended upon to support They had many encouraging reports from these services about two years ago, but their hopes were blasted by the want of appreciation on the part of the intelligent legislator. They had made light of it, and had laughed at it, and they did not seem to appreciate its value. He had worked with these services with a view to securing State aid, knowing that it would quadruple the value of the Signal Service work to the country. One dollar expended in telegraphing to these services would be worth thousands of dollars to the States. Send these Signal Service reports out to cities where no one is to take charge of them, and nothing will be done in the way of distributing them. He hoped to get more favorable action from the legislatures during the coming year. In the mean time all the Signal Service could do to aid in supporting these services was to furnish the franked envelopes and blank forms. The Signal Service had supplied several rain-gauges to certain States, to Tennessee, Ohio, &c. Professor Mell had organized his service without any material State aid, and the Signal Service sends him the indications by telegraph, and he had received the co-operation of railroads in disseminating the information. This is one of the prime objects of the Signal Service. It is an nating the information. This is one of the prime objects of vite significant and interesting work. They were accumulating data in Washington, and important and interesting work. They were accumulating data in Washington, and the service was unable to give the results to the people for want of facilities. Associated Press did not reach certain localities, and the State services could be of great use in this respect, and he hoped they would be able to increase the number of organiza-The plan to pay the observers, as was done by Professor Raker in Michigan, be a good one. _ The organization in Iowa is very similar to the one in Ohio, but not might be a good one. The organization in Iowa is very similar to the one in Ohio, but not so well supported. He was sorry that a representative of the service was not present. This service had a good mode of making its reports; they are well tabulated and discussed.

Mr. Houston suggested that in those States where State aid could not be obtained, they might get aid from the State in an indirect way. It had been done in Indiana.

Mr. Davis said they had gone on for more than a year in New England without asking State aid, but they now propose to ask for funds to be disbursed through the agri-

cultural societies of the State.

Mr. Mell said that in Alabama he had made no direct appeal to the legislature. He had resorted to other means. The State Agricultural and Technological College, at Auburn, with which he was connected, has an appropriation from the General Government; besides that, the State government had given it about \$30,000 for the purpose of scientific investigation. He prevailed upon the board of trustees to give him a sufficient amount of money to publish his monthly bulletin. Connected with the college was a printing establishment worked by the students, and he put these boys to work on the bulletin, and the form of bulletin, cards, &c., shown was the result of the students' work. He could issue all the bulletins necessary in that way. Many of his observers wanted pay for the work they were doing. Of course, they could not do this. He proposes at the next session of the legislature to make a forcible appeal for recognition, and he had some reason to suppose that he would be successful.

Lieutenant Dunwoody stated there was a bill before Congress to appropriate a large sum of money to enable the Chief Signal Officer to distribute the weather indications by means of signals, &c. If such a bill as that became a law, there will be no trouble about the State weather services, because the Signal Service would have the money to spend, say \$3,000 in each State, and each State would have a substantial organization, and probably a signal man to assist in collecting and discussing their data. He did not know of an appropriation before Congress that would be more acceptable to the people of the country or more beneficial. He, however, did not think it would be favorably considered. A bill had been introduced by Mr. Cabell for a large amount of money for the purpose of enabling the Chief Signal Officer to telegraph the indications to the postoffices, &c., throughout the country. If there is any opportunity or chance for success in this matter, it will solve the question of State weather services, and there would be

State services in every State in the Union.

Lieutenant Woodruff said, in reference to the bill spoken of by Lieutenant Dunwoody, that as it was a measure of so much importance to the interest of the State weather services, and to the people of the State themselves, it would be very proper for the representatives of the State services present to see what they could do to enable the bill to become a law, that is, they should take such action as to impress upon their representatives in Congress the necessity for the passage of such a bill. The State services should use their influence in having the bill passed. There is no doubt but that the money would be of very great assistance in the direction referred to.

The chair said if there was no further discussion upon the general question under consideration, there were two special questions yet to be considered to which he had al-

ready referred.

There being no objection, discussion of the general question of organization of State weather services was closed without action.

The chair then laid before the conference the special topic: "The relation of voluntary observers to the Signal Service and the State weather service in States where local services are established.

Mr. Davis stated that as he had suggested the question in that form he would give his reasons. It seemed to him there was a necessity for the voluntary observers to continue to report to the chiefs of the local services, and in the cases of new voluntary observers it was an aid to the local services, and they should be officially requested to report to these services, because the services are just so far discredited in the eyes of the local observers. The conference ought to take some such action. He inquired whether the policy of the Signal Office was settled in that respect, and if so, in what direction was it settled.

Lieutenant Dunwoody said with regard to the organization of the State services, it was originally intended to transfer the voluntary observers to the State services as soon as they were properly organized. He thought it was very well to carry out that line of action; and that would be the policy of the Signal Office. But as there were a number of States where local services do not exist, it would be necessary for the office to continue their voluntary observers in those States.

Mr. Davis said if such was the case the conference need take no action upon the subject. His society would like to be recognized as the local authority in the New England States.

There being no further discussion, the question under consideration was passed over without action.

The conference then considered the last suggested topic: "How far voluntary observers and the State weather services should make separate reports to the Chief Signal Officer for the Monthly Weather Review, and how far these should be made by the chiefs

Mr. Upton said that as he had suggested the topic it would be well for him to state the reason for bringing it up. It had been made necessary by the facts brought out by the last question discussed. The difficulty in New England was that some observers reported to his service and some to the Chief Signal Officer, and there was a third class who reported to another body. If all the voluntary observers reported to the chiefs of the local services, and the Chief Signal Officer received all his reports from the local chiefs, the difficulty would be obviated. The question of documents, which these voluntary observers received in return for their reports, was a source of difficulty. If the documents were turned over to the chiefs of the various services and by them sent out to their voluntary observers, that would do away with this difficulty. If these observers reported to the Chief Signal Officer they got these documents free, while if they would report to the local chiefs they would not get them, because the chiefs have usually not enough to go around. The twenty-five documents received by the New England service were sent to those observers who do not receive them from the Chief Signal Officer. the transfer of these documents to the State services for distribution could be arranged the plan of having all voluntary observers report to the local services could be completed.

Lieutenant Woodruff said it seemed to him that the question of documents was a little matter of detail that could be regulated in the Signal Office. If the chiefs of the State services sent in lists of their observers to the Chief Signal Officer the publications could be mailed the chiefs from the Signal Office. If the plan was brought to the attention of the Chief Signal Officer he would certainly agree to it.

There being no further discussion, the president declared the consideration of the subject closed without action.

Mr. Fuertes inquired if there were any means provided for publishing the proceedings of the conference.

The chair stated that it was the intention to turn over the report of the proceedings to the Chief Signal Officer to publish as a part of his annual report, and it might possibly be printed in pamphlet form.

Mr. Upton said undoubtedly a summary of the proceedings would be printed in the

American Meteorological Journal.

Mr. Davis asked that the secretary be authorized to publish in certain scientific journals an abstract of the proceedings and account of the action taken by the conference on certain subjects.

Mr. Upton moved that the secretary have authority to publish in such scientific journals he chose such abstracts of the proceedings of the conference as he thought desirable or suitable.

The motion was adopted.

The chair announced the names of Professors Mendenhall and Fuertes, Lieutenant Dunwoody, Professors Upton and Payne as the committee on the permanent organization of the conference. The chair said the object of this committee implied the meeting of the conference again, and it had been suggested that when the adjournment of the present session took place it be to meet at the call of the committee on permanent organization, and if there was no objection it would be so understood.

There was no objection, and it was so ordered.

The chair inquired if there was any further business to be brought before the conference. The chair thought it was right that the thanks of the conference be extended to the director of the National Museum for his courtesies to the conference.

The following motion was then adopted:

That the thanks of the conference be extended to the director of the National Museum, through the chairman, for providing a place of meeting for the conference.

Lieutenant Dunwoody suggested that the chair invite the members of the conference

to visit the Signal Office on the following day.

The chair stated he was glad to have an opportunity of extending the invitation, and hoped that the members of the conference remaining over would visit the office of the Chief Signal Officer on the next day.

The chair felt complimented in being selected to preside over the conference, and it had been a pleasure to him to preside over their deliberations. It had been a very profit-

able session

Lieutenant Woodruff moved that the thanks of the conference be extended to the chairman and secretary for the efficient manner in which they had performed their duties.

The motion was adopted.

The conference then adjourned to meet at the call of the committee on permanent organization.

FEBRUARY 20, 1886.

DEAR SIR: I regret to be compelled to state that it will be impossible forme to attend the meeting of the chiefs of the State weather services and of meteorologists called by

your invitation for the 24th and 25th instants.

My interest is rather in climatology than in meteorology proper, and I am hardly prepared to make suggestions or discuss the questions which relate to the work of observing and recording phenomena of weather. There is an important suggestion however about the proper location of stations which I venture to make, and it may be one of the subjects for your discussion, since the end of meteorology is the elucidation of the factors of climate.

I have inclosed a short communication on the New York State stations and their geographical position, which may be of some value as suggesting our needs.

Yours, respectfully,

JOHN C. SMOCK.

General W. B. HAZEN, Chief Signal Officer, U. S. A.

### THE NEW YORK WEATHER STATIONS.

The importance of geographical positions in the selection of meteorological stations is well illustrated in New York. The number of stations from which reports are now received by the Signal Office, the War Department, and the New England Meteorological Society is twenty-six. If that number of stations were quadrupled it would not be too large for so diversified a surface and so extensive a territory.

A station for each 450 square miles would not be too close. At present the average area per station is 1,800 square miles.

But the irregular distribution makes it practically a much larger area.

In the appended table these 26 stations are grouped according to the several well defined and natural subdivisions of the State.

There are 10 such divisions or districts, and they have stations in them as follows: First, the maritime or Atlantic coast district, consisting of Long Island, Staten Island, New York, and parts of Rockland and Westchester Counties; has now six stations.

Four of them are within 5 miles of New York City Hall; and Long Island (120 miles

long) has one station, outside of Brooklyn.

The Hudson Highlands, consisting of an elevated belt stretching from New Jersey to Connecticut, nearly, has two only, neither of which can be considered as being in representative locations.

The long Hudson Champlain Valley, stretching north to Canada, has three, or if Platts-burg be included, four stations.

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The Catskill Plateau, which rises from 1,000 to 4,000 feet above the ocean (a mean of at least 2,000 feet) and which may be said to include the country southwest to the Pennsylvania line, and west into the Susquehanna watershed, has one station.

In the Mohawk Valley there are none, and so in the large Adirondack region there

are no stations which report observations.

Plattsburg (if not assigned to the Champlain Valley) becomes the sole representative for the Saint Lawrence Valley below Lake Ontario.

In the Lake Shore belt there are several stations of the Signal Office of the United States,

and three voluntary observers.

This district may be said to be the best cared for in the State. In what has been fermed the "central belt," the country back from the lakes and extending to the southern plateau counties, there are three stations.

The southern counties occupying the Pennsylvania border and elevated 1,000 to 2,000

feet above tide level, have four stations.

The inadequacy of the stations, as now located to represent the districts, has been shown in that there are two districts which are without stations, and three have (practically) one each only.

The climate of our mountainous regions is neglected, so far as observations which are now being taken are concerned. In view of this deficiency I have thought that possibly the Signal Office might be desirous of knowing of it and might consider the suggestion of making some efforts to solicit the assistance of other voluntary observers in addition to those now on its list in States where no State weather service exists.

The inauguration of such service in the State of New York is a matter of consideration, and to be hoped for speedily, but until that time it is necessary to use all the agencies at hand; and these are nearly all in the service of the United States Signal Office.

If that office can afford us any further or more material help in the establishment of new stations, carefully located, it will do a good work in furthering the study of the climate of the State.

NOTE.—In the appended tabular statement the second column gives the names of the districts; the third, the list of stations; the fourth, the number of the stations per district; and the last column the department or society to which the stations report.

### New York meteorological stations, 1885 and 1886.

[S. S. V.: Signal Service Voluntary Observer. N. E. M. S.: New England Meteorological Society. Mil. Post: United States Military Post. S. S.: Signal Service.

Number.	Districts,	Locality and county.	Number of stations.	Sodety to whichsta- tions re-
1	Atlantic coast districts	Setauket, Long Island	8 4 5 6	8. S. V. N. E. M. S. S. S. Mil. Post, Mil. Post. S. S. V.
2	Highlands of Hudson	West Point, Orange County Mountainville	1 2	Mil. Post. 8.8. V.
8	Hudson—Champlain Valley	Lebanon Springs, Colorado County	1	N.E.M.S. 8.8. N.E.M.S.
4 5	Catakill Plateau	Cooperstown, Otsego County	ĭ	8.S.V.
6	Adirondacks	,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	*******	
7	Saint Lawrence Valley		1	Mil. Post.
8	Lake Shore belt	Oswego, Oswego County Palermo, Oswego County	1	8.8. 8.8.V.
		North Volney, Oswego County	28	8. 8. V.
		Palmyra, Wayne County	4	8. 8. V.
		Rochester, Monroe County	5 6	8.8.
9,	Central belt	Buffalo, Erie County Syracuse, Onondaga County		8.8.V.
•,	COLLEGE COLD	Aubura, Cayuga County	2	aav.
		Le Roy, Genesce County	8	8.8.V.
10	Southern Plateau	Ithaca, Tompkins County		8.8.V.
		Factoryville, Tioga County Penn Yan, Yates County	2 8	8.8.V.
	1	Humphrey, Cattaraugus County		8.8.V.
	<u> </u>			1

POST-OFFICE DEPARTMENT. OFFICE OF ASSISTANT ATTORNEY-GENERAL. Washington, D. C., March 17, 1886.

SIR: The communication of General W. B. Hazen, Chief Signal Officer, United States Army, of date January 28, ultimo, was this day referred to me with directions to advise upon the questions therein presented as to the extent of the right to use the penalty envelope for the purposes of collecting information by officers of the Signal Service.

General Hazen says that the Signal Service has been co-operating with a number of local services in the various States. These services are the agents of the Signal Service; they are voluntary observers of the Signal Service and the reports are collected at the State centers and transmitted to the office of the service at the War Department.

These State services, as I understand, are under the charge of chiefs, who organize corps of observers in the several portion of the State; the latter report to the State chiefs, who compile and forward their reports to the Signal Office.

The use of the official or penalty envelope is required in forwarding as well as in the collection of these reports. From the information thus obtained is compiled or prepared a summary which is published in a monthly bulletin by authority of the Secretary of War. The question presented is whether this use to the extent desired is authorized by

The State agencies and the corps of "voluntary observers" cannot be said to be "officers of the United States Government." Though they render valuable service in collecting and furnishing information of a public and official character, they are but unofficial volunteers with none of the liabilities or responsibilities of an officer. The act of July 5, 1884 (23 Stat. 158), provides "that any Department or officer authorized to use the penalty envelopes may inclose them with return address to any person or persons from whom official information is desired, the same to be used only to cover such official

information and indorsements relating thereto."

This provision would authorize the Chief Signal Officer or any officer of his corps charged with the duty of collecting such information, to request it to be furnished from a private citizen or person not an officer of the Government, and furnish him official envelopes properly addressed. But it confers no authority to furnish these pensity envelopes with no return address thereon to local agencies or officers of the Government, to be by them distributed to other subagencies or non-official persons. Such a use is not within the purview of the act as it now stands, and the most liberal rule of interpretation cannot extend it so far. An officer can furnish return envelopes with return address to any unofficial person from or through whom he desires official information, but he cannot furnish such unofficial person an unlimited supply of envelopes to be by him used in making inquiries, and collecting information upon the same subject, and to be furnished by him to other unofficial persons to correspond with him, so that he may compile the results of their information and send it to the Signal Office.

It may be very desirable, and for the public interest, to make all these matters relating to the weather service free of postage by extending to it the right to use all penalty envelopes that may be necessary in collecting information, but I am forced to the conclusion that the statute must be changed in order to confer the authority. Its present terms

cannot be stretched so far.

These views are in harmony with several opinions furnished to this Department by the Attorney-General.

Very respectfully,

EDWIN E. BRYANT, Assistant Attorney-General Post-Office Department.

Hon. WILLIAM F. VILAS, Postmaster-General.

A true copy.

B. M. PURSSELL, Second Lieutenant, Signal Corps, U. S. Army.

POST-OFFICE DEPARTMENT. OFFICE OF THE POSTMASTER-GENERAL. Washington, D. C., March 18, 1886.

SIB: Your communication of the 28th of January, in regard to the use by voluntary observers of penalty envelopes, was received by me but two days ago. In response thereto I transmit to you a copy of the opinion of the Assistant Attorney-General of this Department, from which you will see that the use of such envelopes as you inclosed a sample of, and the manner in which you speak of their being used, is illegal and cannot be permitted. The extent to which the law authorizes your office to send out envelopes is to that the opportunity for reply to such inquiries as you may directly put, but it is entirely inadmissible to place envelopes in the hands of unofficial persons to use at their discretion. In order to authorize the use of the envelope in the manner in which you desire it legislation should be secured.

Very respectfully,

WM. F. VILAS,

Postmaster-General.

Brig. Gen. W. B. HAZEN, Chief Signal Officer, U. S. Army.

A true copy.

B. M. PURSSELL, Second Lieutenant, Signal Corps, U. S. Army.

[H. R. 9896. In the House of Representatives, July 19, 1896. Read twice, referred to the Committee on the Post-Office and Post-Roads, and ordered to be printed.]

Mr. CALDWELL introduced the following bill:

A BILL authorizing the transmission of weather reports through the mails free of postage.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled. That the provisions of the fifth and sixth sections of the act entitled "An act establishing post-roads, and for other purposes," approved March 3, 1877, for the transmission of official mail matter, be, and is hereby, extended to all observers and agents co-operating with the Signal Service in collecting meteorological reports for the benefit of commerce and agriculture; and that all official mail matter relating to weather reports may be transmitted through the mails free of postage, the envelopes containing said mail matter in all cases to bear an appropriate indorsement of the name and address of the observer from whom the same is transmitted, under the words "official business weather reports" with a statement of the penalty for their misuse.

[S. 2004. Forty-ninth Congress, first session. In the Senate of the United States, March 30, 1886.]

Mr. CONGER introduced the following bill: which was read twice, and referred to the Committee on Post-Offices and Post-Roads.

A BILL authorizing the transmission of weather reports, storm, and flood warnings, and the announcement of the approach of cold waves through the mails free of postage.

B: it enacted by the Senate and House of Representatives of the United States of America in Congress assembled. That the provisions of the fifth and sixth sections of the act entitled "An act establishing post-roads, and for other purposes," approved March 3, 1877, for the transmission of official mail matter, be, and is hereby, extended to all observers and agents co-operating with the Signal Service in collecting meteorolgical reports for the benefit of commerce and agriculture; and that all official mail matter relating to weather reports, or containing warning of the approach of storms, floods, frosts, or cold waves may be transmitted through the mail free of postage; the envelopes containing said mail matter in all cases to bear an appropriate indorsement of the name and address of the observer from whom the same is transmitted, under the words "official business, weather reports," with a statement of the penalty for their misuse.

SIGNAL OFFICE, WAR DEPARTMENT, Washington City, September 9, 1886.

The indications board will make a careful examination of the several systems of weather signals now in use, or proposed for use, in connection with the Signal Service, U. S. Army. The board will make a practical test of the various systems and will examine any reports on file in this office from persons who have had experience in the use of signals.

A report will be made on the relative merits of the several signal systems examined, with recommendations.

By order of the Acting Chief Signal Officer:

J. MITCHELL, Second Licutenant Signal Corps, U. S. A.

SIGNAL OFFICE, WAR DEPARTMENT,
Washington City, September 17, 1886.

SIR: I have the honor herewith to forward the report of the indications board on the several systems of weather signals in use or proposed for use. This report is made in

accordance with instructions received in Memorandum Order No. 233, office of Chief Signal Officer.

Very respectfully, your obedient servant.

H. H. C. DUNWOODY,

First Lieutenant, Fourth Artillery, Assistant, President of Board. ACTING CHIEF SIGNAL OFFICER, U.S. A.

REPORT OF INDICATIONS BOARD ON THE SEVERAL SYSTEMS OF WEATHER SIGNALS IN USE OR PROPOSED FOR USE.

In accordance with instructions contained in Memorandum No. 233, office of Chief Signal Officer, the indications board has carefully considered the several systems of weather signals and made tests of visibility of the different systems under various con-These systems can all be classed under three general heads: (1) those employing symbols of differing color and shape displayed on a flag of uniform ground, as the weather signals now used by this service; (2) those employing flags of different colors, each flag being wholly of one color; (3) those employing solid symbols, depending for meaning on their shape, such as the "ball," "drum," "cone," system. The board found that even under the most favorable conditions the symbols of the first class were not visible to the naked eye at a distance exceeding 400 yards. Moreover, whenever the wind is light these flags hang in such a way that the symbol displayed thereon is not legible. Neither can they be read when one is directly to the windward of them.

None of these objections applied to the second system. The flags of this class tested ere those used by the Alabama State Weather Service. These flags could be read at a were those used by the Alabama State Weather Service. much greater distance than those of the first class, and, as only the color need be seen to give their meaning, they were found to be legible when wrapped around the staff, and in all positions of the observer. These flags could be easily read with field glasses at a distance of two and a half miles, while the flags of the first class could not be distinguished, one from the other. Solid signals, the ball, drum, and cone, were also displayed, and were found to become illegible at about the same distance as the flags of the first class. These symbols were 20 inches in diameter. From observation of a ball 4 feet in diameter, at a distance of two miles and a half, it became evident that if solid symbols are employed they must be at least 4 feet in diameter in order to be visible at the same distance as the flags of the second class. This makes them too bulky and too expensive for general use.

The board therefore finds that, considering cost, convenience, and legibility, the best system of weather and temperature signals is one in which the several symbols are flags of solid colors, and, as the Alabama system is already in general use throughout the South, the board recommends that this system be adopted by the Signal Service on Janvary 1, 1887, and that the system now in use be discarded on that date. The board further recommends that a circular letter be drawn up and sent to all interested in the display of weather and temperature signals, informing them of this change and the reasons therefor, and advising them to purchase the new flags as soon as those of the present system now in use shall become worn and unserviceable. In this way it is believed the change can be effected with the least trouble and expense. The Alabama system of sig-

mals is as follows:

Blue square flag: general rains. Yellow square flag: local rains. White square flag: fair weather.

Black pennant hoisted above weather flag: higher temperature. Black pennant hoisted below weather flag: lower temperature. Absence of pennant denotes no decided change in temperature.

The cold-wave flag at present is a white square flag with black center.

H. H. C. DUNWOODY, First Lieutenant, Fourth Artillery, Assistant, President. JOS. S. POWELL,

Second Lieutenant, Signal Corps, United States Army, Assistant. JNO. P. FINLEY,

Second Lieutenant, Signal Corps, United States Army, Assistant. J. E. MAXFIELD,

Second Lieutenant, Signal Corps, United States Army, Assistant, Recorder.

# APPENDIX 4.

### REPORT ON COLD-WAVE SIGNALS.

SIGNAL OFFICE, WAR DEPARTMENT, Washington City, June 30, 1886.

To the CHIEF SIGNAL OFFICER OF THE ARMY, Washington City:

SIE: I have the honor to submit the following report upon the work performed in connection with the system of cold-wave warnings during the fiscal year ending June 30, 1886:

The progress made in this important and popular branch of meteorological work has been highly satisfactory, not only as regards the accuracy of predictions, but also in the greatly increased facilities for disseminating the warnings of the approach of cold waves.

The interest manifested by the general public and the expense incurred by a large number of citizens in the purchase and proper display of cold-wave signal flags sufficiently attest the value and importance of the system, and I have no hesitation in saying that, judging from the reports made by our observers during the year upon the benefits derived from the warnings and the prompt display of the signal, property to the value of many millions of dollars has been saved.

The unexpected arrival of sudden changes in temperature is always disastrous to the interests of persons engaged in agriculture and stock-farming, of shippers of perishable goods, manufacturers, railroad and canal companies, merchants, cotton and other planters; and the purpose of the Chief Signal Officer in sending out these warnings is that persons engaged in all industries liable to be affected by cold weather or sudden changes in temperature may be enabled to take the precautions necessary to protect their interests by being informed in ample time of the coming cold waves, which it is possible for the service to predict with an average accuracy of from 85 to 100 per cent.

When it is expected that the temperature will fall suddenly fifteen to thirty degrees or more in any section of the country, the cold-wave warning is immediately telegraphed to selected stations of the Signal Service, from twenty-four to forty-eight hours in advance, at which the cold-wave flags are immediately hoisted, in order that the public may be fully informed. The information is then sent by telephone and telegraph, whenever practicable, to all towns and railroad stations in the vicinity of the Signal Service stations displaying the signal.

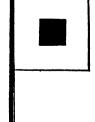
Cold-wave signals are not ordered unless a temperature of forty-five degrees, or less, is expected. When the temperature is expected to fall twenty degrees, or more, in any district, and not reach forty-five degrees, announcement of cool wave approaching is made in the "indications." No signals are displayed for cool waves.

The cold-wave signal is a white flag, six or eight feet square, with black center about two feet square. It is lowered when the wave arrives.

A full description of the signal and the principal features of the system was published in the last annual report of the Chief Signal Officer.

In various studies upon the origin and movements of areas of high and low barometer it has been shown generally that they move almost invariably across the United States from west to east. The determination of the movement of the area of low barometer largely determines the movement of the following high barometer. Now, most of the areas of low barometer are formed in the region east of the Rocky Mountains, and as these areas move eastwardly the high moves in, and we have accompanying a cold wave of more

or less intensity. Even if the low area pursue an abnormal track, the circulation of the winds about the high and low is such as to produce almost invariably a decided fall in temperature if the low be eastward of the high.



A careful investigation of the progressive motion of cold waves proves that they may be divided into three classes, as follows:

(1.) Those that move directly across the country from west to east, and which follow an almost invariable path along the chain of great lakes and across New England; these do not extend to the States south of the Ohio river.

(2.) Those which move in a southeasterly direction and cover the entire country in

their progress.

(3.) Those which move southerly from Montana and Dakota to Texas, thence through the Gulf States, and then spread easterly over the Atlantic coast States. It sometimes occurs with this class that the cold wave is first felt at Saint Louis and Shreveport before being felt at Saint Paul and Chicago, and that then the cold wave takes the general movement eastward of the second class.

There are about 24 per cent. of cold waves of the first class, 54 per cent. of the second.

and 22 per cent. of the third.

The following general results have been arrived at since the beginning of the study of

the character and movement of cold waves in the United States:

(1) They appear in the extreme northwest, and about 86 per cent. originate or are first felt east of the Rocky Mountains, and 14 per cent. come across these mountains.

(2) Their appearance in the Northwest is independent of the time of day.

- (3) By far the greatest number of cold waves travel across the country from Helena, Mont., to the Atlantic Ocean in thirty-two to forty hours.
- (4) The most decided changes of temperature for the twenty-four hours occur in the afternoon, and this is particularly true of the sudden fall during the passage of a cold

(5) The most decided and most severe cold waves follow severe storms.

(6) The maximum effect, that is, the minimum temperature, occurs when the barom-

eter is the highest above the normal.

The following extracts from the reports of our observers indicate the value of this branch of Signal Service work. The reports cover the period from July 1, 1885, to June

Abilene, Tex.—Total number of signals displayed, 13; justified, 11; not justified, 2. Warnings were considered by the business interests generally to be of considerable value. Principally beneficial to dealers in live stock and perishable goods. Business men put the utmost confidence in the warnings issued by the Chief Signal Officer. (L. R. 4605, Obs., 1886.)

Albany, N. Y.—Total number of signals displayed, 14; justified, 13; not justified, 1. Copies of warnings were furnished the Delaware and Hudson Canal Railroad Company; People's Line of Steamers; Schuyler Towing Line of Steamers; Hudson River Telephone Company; and State superintendent of canals. Fifteen or twenty towns received the warnings by these means. The Delaware and Hudson Canal Railroad Company are preparing symbols to be displayed on their cars, and, when completed, the warnings will be observed at ninety-one stations from Binghamton, N. Y., to Rutland, Vt., and Rouse's Point, N. Y.

This information was of great value to vessel interests, and the saving to dealers in

fish, oysters, fruit, wine, &c., is incalculable. (L. R. 4543, Obs., 1886.)

Atlanta, Ga.—Total number of signals displayed, 13; justified, 10; not justified, 3. Warnings were furnished the Richmond and Danville Railroad; Georgia Pacific Railroad; Western and Atlantic Railroad; Central; and Atlanta and West Point Railroad. Estimated number of towns receiving benefits from the warnings is fifty. (L. R. 4542, Obs., 1886.)

Augusta, Ga.—Total number of signals displayed, 15; justified, 13; not justified, 2. Warnings furnished the following railroads: Augusta and Knoxville; Port Royal and Augusta; Gibson and Sandersville. At least twenty-two towns were immediately informed of the approach of cold waves. Merchants were especially benefited by the

warnings. (L. R. 4993, Obs., 1886.)

Boltimore, Md.—Total number of signals displayed, 18; justified, 15; not justified, 3.

Warnings were furnished the Corn Exchange, Merchants' Reading Room, Branch Hydrographic Office, Telephone Exchange, Baltimore and Ohio Railroad, and Baltimore and Ohio, Western Union, and United Lines Telegraph Companies. At least forty towns received the benefit of the warnings. The past winter was unusually severe, and as there are many interests here which are affected by sudden temperature changes a great deal of attention was paid to the warnings issued by the service. Shipping was benefited to the extent of many thousands of dollars. The shipments of perishable freight were also regulated by these warnings. When it is stated that upward of \$12,000,000 are invested in the oyster-packing business, employing about 45,000 hands, some idea can be formed of the loss which would be sustained by forwarding at an inauspicious time the product of only one day. Ten or more years ago the spoiling and sometimes the loss of entire shipments were frequent; during last winter but little complaint was heard

in this direction. (L. R. 4539, Obs., 1886.)

Bufalo, N. Y.—Total number of signals displayed, 15; all justified. Warnings were furnished the following railroads: Rochester, Buffalo, and Pittsburg; Erie; Lake Shore; and the Grand Trunk; also the Western Union and Baltimore and Ohio Telegraph offices, and the Bell Telephone Exchange. It is estimated that about five hundred towns and cities received the benefit of the warnings. Prominent shippers of and dealers in grain and produce state that their business was conducted on the strength of our There is no information sent out from the Signal Office that has given better

satisfaction to the entire community. (L. R. 4570, Obs., 1886.)

Boston, Mass.—The total number of signals displayed, 16; all justified. Warnings were furnished the following railroads: Boston and Maine; Eastern; Boston and Lowell; Old Colony; New York and New England; Fitchburg; Boston and Albany; Boston and Providence; and the Boston, Revere Beach and Lynn. Over two hundred and seventyfive towns and stations received the benefit of the warnings. Managers of telephone exchanges in Worcester, Springfield, Fitchburg, North Adams, Orange, Northampton, and Palmer, Mass., Lebanon and Manchester, N. H., and Brattleborough, Vt., displayed cold-wave signals and forwarded the information to other cities. About fifty towns were furnished with the warnings in this manner. Many members of the Boston Fruit and Produce Exchange state that their shipments were regulated entirely by the temperature predictions. Fruit dealers always consulted this office before making a shipment. (L.

R. 4818, Obs., 1886.)

Cairo, Ill.—Total number of signals displayed, 21; justified, 19; not justified, 2.

Cairo, Ill.—Total number of signals displayed, 21; justified, 19; not justified, 2. Warnings were furnished the following railroads: Illinois Central; Mobile and Ohio; Texas and Saint Louis; Iron Mountain; Chicago, Vincennes and Cairo; and Cairo and Saint Louis. The officers of a number of steamboat lines consulted the warnings. Fifty-eight towns received the benefit of the warnings. This city being the point of call for all Ohio and Mississippi River steamers, the value of the warnings to the shipping interests of these rivers cannot be estimated. Shippers of perishable goods saved thousands of dollars by taking advantage of the information given. (L. R. 4568, Obs.,

Charleston, S. C.—Total number of signals displayed, 15; all justified. The officials of the South Carolina, Northeastern, and Charleston and Savannah Railroad Companies telegraphed the warnings to all stations on their respective roads, and about fifty towns received them. The amount of perishable goods saved by a single warning, that of Jan-

uary 8, 1886, was valued at \$5,000. (L. R. 4612, Obs., 1886.)

Chicago, Ill.—Total number of signals displayed, 20; justified, 15; not justified, 5. Warnings were furnished the following railroads: Saint Paul, Minneapolis and Omaha; Chicago and Alton; Chicago and Eastern Illinois; Grand Trunk; Chicago, Rock Island and Pacific; Chicago and Northwestern; Lake Shore and Michigan Southern. Five hundred towns were, in all probability, supplied with cold-wave warnings through the medium of these railroads. This information was of special benefit to dealers in perishable goods, packers and shippers of fresh meat, brewers, and the railroads. (L. R. 4610, Obs., 1886.)

Cincinnati, Ohio.—Total number of signals displayed, 18; justified, 16; not justified, 2. Warnings were furnished eleven railroad companies. The signal of January 7, 1886, was the means of saving thousands of dollars. The general public placed great reliance in the predictions, and in every case made preparations accordingly. (L. R. 4606, Obs.,

1886.)

Cleveland, Ohio.—Total number of signals displayed, 19; justified, 18; not justified, 1. Warnings were furnished the Lake Shore and Michigan Southern Railroad; New York, Chicago and Saint Louis Railroad; New York and Ohio Railroad; and Cleveland, Columbus, Cincinnati and Indianapolis Railroad. One hundred stations received

the benefit of the information. (L. R. 4393, Obs., 1886.)

Columbus, Ohio.—Total number of signals displayed, 18; justified, 17; not justified, 1.

Warnings were furnished the Sciota Valley Railroad; Columbus and Cincinnati Midland Railroad; Columbus, Hocking Valley and Toledo Railroad. Eighty-five stations received the benefit of the warnings. Cold-wave signal flags were displayed on the cars of the Columbus and Cincinnati Midland Railroad, Columbus, Hocking Valley and Toledo Railroad, and Cleveland, Mount Vernon and Delaware Railroad. (L. R. 4467, Obs., 1886.)

Des Moines, Iowa.—Total number of signals displayed, 20; justified, 17; not justified, 3. Warnings were furnished the Chicago, Rock Island and Pacific Railroad; Chicago and Northwestern Railroad; Osceola and Southern Railroad, and Wabash and Saint Louis Railroad. The information was distributed by the railroad companies and the Western Union Telegraph Company to four hundred and forty-three points, comprising nearly all the important towns in Iowa. Large shipments of perishable goods were saved, and a loss of several thousand dollars prevented by means of these warnings. (L. R. 4672,

Obs., 1886.)

Detroit, Mich.—Total number of signals displayed, 17; justified, 16; not justified, 1. The cold-wave signal was displayed by interested citizens in forty-seven leading cities in The warnings were furnished sixty-four stations by the different railroad companies. No shipments of fruit, potatoes, or perishable articles were made during the progress of a cold wave, and an aggregate of \$1,000,000 worth of property has been aved to shippers and citizens of Michigan by the timely warnings. (L. R. 4671, Obs.,

Grand Haven, Mich.—Total number of signals displayed, 14; justified, 9; not justifled, 5. The signal was displayed by interested citizens in fourteen leading cities, and the information distributed to one hundred and thirty-two towns by the railroad com-

panies. It is estimated that 41,000 persons engaged in farming, horticulture, &c., derived benefit from these warnings. (L. R. 4615, Obs., 1886.)

Jacksonville, Fla.—Total number of signals displayed, 15; justified, 14; not justified, 1. The railroad companies distributed the warnings to one hundred and fifteen towns in They were of great benefit to the orange and vegetable growers. (L. R. 4544. the State.

Obs., 1886.)

Leavenworth, Kans.—Total number of signals displayed, 21; justified, 18; not justified, 3. The warnings were sent to one hundred and twenty-five towns through the co-operation of the railroads. A single display resulted in saving several car-loads of potatoes.

(L. R. 4676, Obs., 1886.)

Memphis, Tenn.—Total number of signals displayed, 19; justified, 16; not justified, 3. Warnings were distributed by the railroads, telegraph, and telephone companies to two warnings were distributed by the railroads, telegraph, and telephone companies to two hundred and fifty-two towns. The information of approaching cold weather was of advantage in the care of crops and stock, and of perishable goods in houses, stores, and in transit; also in the protection of plants and water-pipes, in treating the sick, and in general matters of health. (L. R. 4710, Obs., 1886.)

Mobile, Ala.—Total number of signals displayed, 9; justified, 8; not justified, 1.
Displays were highly appreciated and have been of great benefit. Mr. John G. Friend,

secretary of the Mobile County Gardeners' Association, states that the cold-wave displays resulted in a saving to the gardeners in his county of \$50,000. (L. R. 4613, Obs.,

1886.)

Naskville, Tenn.—Total number of signals displayed, 18; justified, 16; not justified, 2. The warnings were distributed by the railroad, telegraph, and telephone companies to sixty-three towns. Signal flags were displayed at eleven points in Nashville and adjacent towns. The information was telephoned to fifty-seven merchants, farmers, stock-brokers, florists, and gardeners in Nashville and vicinity, and the warnings were bulletined at forty-two prominent points throughout the city. The information of approaching cold waves proved of untold value and benefit to farmers, stock-breeders, gardeners, florists, pork-packers, builders, factories, and to commercial interests generally; thousands of water-pipes were protected, cattle comfortably housed, and fruit and commission merchants saved their stock. Citizens spoke in the highest terms of the great benefits accruing from this branch of Signal Service work, and unprecedented demands have been made for the information from merchants and farmers living in the suburbs and surrounding towns. Not a single frost prediction failed during the season, nor did any frost occur which was unan-mounced. (L. R. 4714, Obs., 1886.)

New Orleans, La.—Total number of signals displayed, 13; justified, 10; not justified, 3. About ninety stations and towns received the benefit of the warnings through the rail-road and telephone companies. The signal was displayed by interested citizens in eighteen towns in Louisiana. This information was of great benefit to sugar planters, and single warning was given in time to save them thousands of dollars. The amount of property saved in this State during the season would carry on the entire frost-warning

service for the next ten years. (L. R. 4574, Obs., 1886.)

New York City.—Total number of signals displayed, 17; justified, 16; not justified, 1. The warnings were furnished all the exchanges, clubs, prominent hotels, brokers, bankers, and others in New York City, Brooklyn, and Jersey City, and were bulletined in public places. It is estimated that 1,750,000 persons were thus informed of the approach of a cold wave. The warnings resulted in saving many thousands of dollars, and the cold-wave signal system is regarded by all classes as one of the most valuable features of the Signal Service, and, as the signals have been almost invariably justified, they have been universally heeded. The Foreign Fruit Exchange regulated much of their business by this information, and the members stated that the warnings have proved of incalculable benefit to them. (L. R. 4450, Obs., 1886.)

Philadelphia, Pa.—Total number of signals displayed, 18; justified, 14; not justified, 4. Over one hundred stations and towns received the warnings through the co-operation of the railroad, telephone, and telegraph companies. Merchants, fruit, and produce dealers were greatly benefited by this information. As affecting this community, the timely warning of approaching cold waves is the most valuable part of the practical work of the Signal Service. (L. R. 4616, Obs., 1886.)

Pittsburg, Pa.—Total number of signals displayed, 16; all justified. Fifty stations and towns received the warnings through the railroad and telegraph companies. Shippers of perishable goods and coal and river men were benefited, and the information was of incalculable value to dealers in grain provisions &c. (L. R. 4496, Obs. 1886)

was of incalculable value to dealers in grain, provisions, &c. (L. R. 4496, Obs., 1886.)

Saint Louis, Mo.—Total number of signals displayed, 21; justified, 18; not justified, 3.

Warnings were distributed over the lines of seven railroads. The information was of inestimable value and indispensable during the winter season. (L. R. 4736, Obs., 1886.)

Saint Paul, Minn.—Total number of signals displayed, 20; justified, 11; not justified, 9.

The warnings were distributed to two hundred and twenty-eight stations by the railroad companies. This information was of great benefit to railroads in enabling them to prepare for snow blockades and prevent delays caused by intense cold. Mr. H. C. Hope, superintendent telegraph, Chicago, Saint Paul, Minneapolis and Omaha Railroad, stated

that the benefits to the railroads from a single warning were sufficient to pay the cost of the service for an entire year, and that this warning was undoubtedly the cause of saving several lives. Nothing connected with the service has proved so satisfactory to the

public as the cold-wave system. (L. R. 4673, Obs., 1886.)

Toledo, Ohio.—Total number of signals displayed, 18; justified, 11; not justified, 7.

Through the co-operation of the railroad, telegraph, and telephone companies the warnings were distributed to eight hundred and sixty-nine towns. The Ohio Central Railroad Company states that the warnings of December 9 and 23, 1885, and January 2, 16, and 19, 1886, enabled them to save \$500 per night. The information was of great ben-

List of stations of observation of the United States Signal Service at which the cold-wave signal is displayed and the warnings distributed for the information and benefit of the public.

efit to wholesale dealers in fruit and perishable goods. (L. R. 4545, Obs., 1886.)

Name of station.	Established.	Name of station.		Established.	
Abilene, Tex	Dec. 21, 1885	Little Rock, Ark	May	17, 1864	
Albany, N. Y		Logansport, Ind	July	80, 1884	
Atlanta, Ga		Louisville, Ky	Dec.	26, 1883	
Augusta, Ga. *	April 4, 1885	Lynchburg, Va. *	Apr.	4, 1885	
Buffalo, N. Y	Mar. 8, 1884	Memphis, Tenn	Oct.	17, 1884	
Boston, Mass	July 30, 1884	Milwaukee, Wis	Nov.	6, 1884	
Baltimore, Md	Sept.20, 1884	Mobile, Ala	Dec.	3, 1883	
Chattanooga, Tenn	Mar. 21, 1884	Montgomery, Ala	Nov.		
Chevenne. Wyo	Oct. 2,1885	Nashville, Tenn	Dec.	26, 1883	
Chicago, III	Dec. 26, 1883	New York City	July	30, 1884	
Cincinnati, Ohio	Dec. 26, 1883	New Haven, Conn			
Columbus, Ohio	July 23, 1884	New London, Conn	April	4, 1885	
Concordia, Kans. *		New Orleans, La	Nov.		
Cleveland, Ohio		Norfolk, Va. *	Apr.	4, 1885	
Cairo, Ill		North Platte, Nebr	Oct.	2, 1885	
Charlotte. N. C	Jan. 27, 1885	Omaha, Nebr.*	Apr.	4, 1885	
Charlotte, N. O	April 4, 1885	Oswego, N. Y	Jan.		
Des Moines, Iowa	July 30, 1884	Palestine, Tex	June	14 1886	
Detroit, Mich	July 30, 1884	Philadelphia, Pa	July	80, 1884	
Davenport, Iowa	Nov. 6, 1884	Pittsburg, Pa	July	23 1884	
Donver, Colo	April 4, 1895	Portland, Me. *	Apr.	4 1895	
Dodge City, Kans,	April 4, 1885	Rochester, N. Y	Nov	6, 1884	
Dubuque, Iowa*	April 4, 1885	Springfield, Ill	July	23, 1884	
Erie. Pa	Sept.11, 1885	Saint Louis, Mo	Dec.	26 1883	
Fort Smith, Ark	Apr. 13,1886	Saint Paul, Minn.*	Apr.	4, 1885	
Greencastle. Ind	July 23, 1884	Shreveport, La			
Galveston, Tex	Oct. 17, 1884	Sandusky, Ohio*	Apr.	4, 1885	
Grand Haven, Mich. *	Apr. 4,1885	Savannah, Ga	Apr	4, 1885	
Indianapolis, Ind	July 23, 1884	Sanford, Fla	Jan		
Jacksonville, Fla	Nov. 6, 1884	Toledo, Ohio			
Keokuk. Iowa	Nov. 6, 1884	Vicksburg, Miss. *	Apr.	4, 1885	
Knoxville, Tenn. *	Apr. 4, 1885	Washington City	July	30, 1884	
La Crosse, Wis	Jan. 20, 1886	Washington City	Apr.	4, 1885	
Lamar, Mo	Sept.16, 1885	Yankton, Dak	Oct.	7. 1885	
Leavenworth, Kans	July 30, 1884	1		*, 2000	

Total, 69.

Stations marked thus *, although established as cold-wave display stations on the dates given, did not go into operation until July 1,1885.

List of cities at which the cold-wave signal is displayed, the warnings being telegraphed at the expense of the United States.

Name of city.	Signal Service sta- tion from which the warnings are telegraphed.	Name of city.	Signal Service sta- tion from which the warnings are telegraphed.
Abilene, Tex	Saint Louis, Mo. Lynchburg, Va. Albany, N. Y. Saint Louis, Mo. New York City.	Glasgow, Mo	Saint Louis, Mo. Albany, N. Y.
Ablene, Tex	Lynchburg, Va.	Glasgow, Mo	Albany, N. Y. Detroit, Mich.
Arrow Rock, Mo	Seint Louis Mo	Greenville, Mich	Atlanta, Ga.
Asbury Park, N. J	New York City.	Hannioai, Mo	Saint Louis, Mo.
Ashley, Ill	Saint Louis, Mo. Washington City.	Harlan, Iowa Harper, Kans	Des Moines, Iowa. Saint Louis, Mo.
Bainbridge, Ga	Savannah, Ga.	Hastings, Mich	Detroit, Mich.
Bath, Mc Beaver Dam, Wis	Portland, Me.	Hastings, Mich Hazelton, Ind	Indiauapolis, Ind. Memphis, Tenn.
Heloft Kans	Milwaukee, Wis.	Helena, Ark	Memphis, Tenn.
Billings, Mo	Saint Louis, Mo. Saint Louis, Mo.	Heina, Ark	Saint Louis, Mo. Albany, N. Y. Nashville, Tenn. Albany, N. Y.
Blair, Nebr	Omaha, Nebr. New York City.	Hopkinsville, Ky	Nashville, Tenn.
Bloomington, Ill	Chicago, Iil.	Huntington, W. Va	Cincinnati, Ohio.
Bolivar, Mo Bonnieville, Ky	Chicago, Iil. Saint Louis, Mo.	Independence, Kans	Saint Louis, Mo.
Bonnieville, Ky	Louisville, Ky. Saint Louis, Mo.	Jackson, Mo	Des Moines, Iowa.
Boonville, Mo Bordentown, N. J	Philadelphia, Pa.	Jacksonville, Ill	Saint Louis, Mo.
Boston, Ga Bridgeport, Ill	Savannah, Ga.	Johnstown, N. Y	Albany, N. Y.
Brownsville, Tenn	Saint Louis, Mo. Memphis, Tenn.	JODUD. MO	Saint Louis, Mo. Saint Louis, Mo. Albany, N. Y. Saint Louis, Mo. Saint Louis, Mo. Saint Louis, Mo. Saint Louis, Mo.
Brownsville, Tenn Brunswick, Mo	Memphis, Tenn. Saint Louis, Mo.	Junction City, Kans Kansas City, Mo	Saint Louis, Mo.
Bunker Hill, Ill	Maint Louis Mo	Kandalivilla Ind	Chicago, Ili.
Burbank, Ohlo Burkesville, Ky	Cleveland, Ohio. Nashville, Tenn. Chicago, Ill.	Kennett Square, Pa Kingeton, N. Y Kirksville, Mo Lafayette, Ill.	Chicago, Ill. Philadelphia, Pa. Albany, N. Y. Saint Louis, Mo. Chicago, Ill.
Rutler Incl	Chicago, Ill.	Kirksville, Mo	Saint Louis, Mo.
Caldwell, Kans Cameron, Mo Canandaigus, N. Y	Saint Louis, Mo.	La Grange, Ind	
Canandaigua, N. Y	Rochester, N. Y.	La Porte, Ind	Chicago, Ill. Chicago, Ill.
Canton, Mo Carterville, Mo	Saint Louis, Mo.	La Salle, Ill	Chicago, Ill.
Carthage Mo	Saint Louis, Mo.	La Salle, Ill Latrobe, Pa Laury's Station, Pa	Pitteburg, Pa. Philadelphia, Pa.
Carthage, Mo Catskill, N. Y	Albany, N. Y.	Leipsic, Ohio	l Toledo, Ohio.
Cedar Rapids, Iowa	Des Moines, Iowa.	Ligouier, Ind Lindsey, Ohio	Chicago, Ili.
Centralia, III	Chicago, Ill. Saint Louis, Mo. Saint Louis, Mo. Rochester, N. Y. Saint Louis, Mo. Saint Louis, Mo. Saint Louis, Mo. Albany, N. Y. Des Moines, Iowa. Saint Louis, Mo. Washington City. Chicago, Ill.	Louisiana, Mo	Toledo, Ohio. Saint Louis, Mo.
Charpaign, III	Chicago, Ill. Saint Louis, Mo. Cincinnati, Ohio.	Ludington, Mich	Detroit, Mich.
Charleston, W. Va.	Cincinnati Obio.	Lyons, Iowa Madison, Ind	Chicago, Ill. Indianapolis, Ind.
Charlottesville, Va	Lvnchburg, Va.	Madison Wis	Washington City
Chetopa, Kans	Saint Louis, Mo.	Manchester, Ohio	Cincinnati, Ohio. Nashville, Tenn.
Circleville, Ohio	Chicago, Ill. Cincinnati, Ohio.	Manhattan, Kans	Saint Louis, Mo.
Clay Centre, Kans Clayton, N. Y	Saint Louis, Mo. Oswego, N. Y. Saint Louis, Mo.	Manistique, Mich Marshall, Mo.	Chicago, III.
Cobden III	I Uswego, N. Y. I Saint Louis Mo	Marshall, Mo	Saint Louis, Mo. Cincinnati, Ohio.
Columbia Mo	l Baint Louis, Mo.	Maysville, Ky McKeesport, Pa Meadville, Pa	Pittsburg, Pa.
Corneaut, Ohio	Erie, Pa.	Meadville, Pa	Pittsburg, Pa.
Crawfordsville, Ind	Rochester, N. Y. Indianapolis, Ind. Omaha, Nebr.	Melvin, Ill. Miami, Mo Middletown, Va	Chicago, Ill. Saint Louis, Mo.
Crete, Nebr	Omaha, Nebr.	Middletown, Va	Washington City.
Danville, Ill	Springfield, Ill. Cincinnati, Ohio.	Milan, Tenn Minneapolis, Kans	Memphis, Tenn. Saint Louis, Mo.
Du Onoin III	Saint Louis, Mo. Lynchburg, Va. Pittsburg, Pa. Detroit, Mich.	Minneapolis, Kans. Moberly, Mo	Saint Louis, Mo.
Durham, N. C	Lynchburg, Va.	Montpelier, Ohio	Toledo, Ohio. Saint Louis, Mo.
Durham, N. C.  East Liverpool, Ohio  East Tawas, Mich.	Detroit, Mich.	Montrose, Pa	New York City.
2000 UNIO	i Cincinnati. Unio.	Mount Vernon, Ind	Indianapolis, Ind.
Edinborough, Pa Edwardsville, Ill	Erie, Pa. Saint Louis, Mo.	Neillsville, Wis	New York City. Milwaukee, Wis. Saint Louis, Mo.
M Dorado, Kana	Saint Louis, Mo.		Saint Louis, Mo.
Elk City, Kana	Saint Louis, Mo. Saint Louis, Mo. Saint Louis, Mo. Des Moines, Iowa.	Newburg, N. Y	New York City. Saint Louis, Mo.
Elsworth, Kans Emmetsburg, Iowa	Des Moines, Iowa.	New Haven, Mo	Cleveland, Ohio.
Emporia, Kans	Saint Louis, Mo.	Ohio.	
Pairbury, Nebr	Omaha, Nebr.	North Bangor, N. Y Northville, N. Y	Oswego, N. Y. Albany, N. Y.
Indlay, Ohio	Toledo, Ohio.	Odin, 111	Saint Louis, Mo.
Findlay, Ohio	Omaha, Nebr. Omaha, Nebr. Omaha, Nebr. Toledo, Ohio. Milwaukee, Wis. Pittsburg, Pa. Toledo, Ohio. Albany, N. V.	II UZGensburg, N. Y	Saint Louis, Mo. Oswego, N. Y.
Franklin, Pa	Toledo Obio	Oil City, Pa	Saint Louis Mo.
Fultonville, N. Y	Albany, N. Y.	Oshkosh, Wis	Milwaukee, Wis.
Fremont, Ohio	. Milwaukee, Wis.	Ottawa, Kans Owensborough, Ky	Saint Louis, Mo.
Gallipolis, Ohio	Columbus Ohio	Oxford, Pa	Philadelphia, Pa.
OCDESSO. III	. Chicago. III.	Oxford, Pa Oyster Bay, L. I Palatka, Fla	New York City.
Gibeon City, Ill	. Chicago, Ill.	Palatka, Fla	Jacksonville, Fla.

List of cities at which the cold-wave signal is displayed, &c.—Continued.

Name of city.	Signal Service sta- tion from which the warnings are telegraphed.	Name of city.	Signal Service sta- tion from which the warnings are telegraphed.
Palmyra, Mo	Saint Louis, Mo.	Shelbyville, Ill	Saint Louis, Mo.
Pana, Ill	Saint Louis, Mo.	Southampton, N. Y	New York City.
Paris, Ill	Saint Louis, Mo.	South Bethlehem, Pa	New York City.
Parsons, Kans	Saint Louis, Mo.	Stanberry, Mo	Saint Louis, Mo.
Passaic, N. J		Stevens Point, Wis	Milwaukee, Wis.
Paterson, N. J	New York City.	Tamalco, Ill	Saint Louis, Mo.
Peabody, Kans	Saint Louis, Mo.	Taylorville, Ill	Saint Louis, Mo.
Peoria, Ill	Chicago, Ill.	Terre Haute, Ind	Indianapolis, Ind.
Petersburg, Va	Washington City.	Texarkana, Tex	Shreveport, La.
Pierce City, Mo	Saint Louis, Mo.	Thomasville, Ga	Jacksonville, Fla.
Piqua, Ohio	Cincinnati, Ohio.	Tiffin, Ohio	Toledo, Ohio.
Potosi, Mo	Saint Louis, Mo.	Topeka, Kans	Saint Louis, Mo.
Princeton, Ind	Saint Louis, Mo.	Tracy City, Tenn	Nashville, Tenn.
Princeton, Ky		Trenton, N. J	Philadelphia, Pa.
Pulaski, Ill		Utica, N. Y	Albany, N. Y.
Pulaski, Tenn		Valdosta, Ga	Savannah, Ga.
Quincy, Mich	Detroit, Mich.	Vandalia, Ill	Saint Louis, Mo.
Richmond, Ind	Indianapolis, Ind.	Vevay, Ind	Indianapolis, Ind.
Richmond, Mo		Villa Ridge, Ill	Saint Louis, Mo.
Richmond, Ky	Louisville, Ky.	Washington, Mo	Saint Louis, Mo.
Richmond, Va	Washington City.	Watseka, Ill	Chicago, Ill.
Ripley, Ohio	Cincinnati, Obio.	Waynesborough, Va	Lynchburg, Va.
Rolla, Mo	Saint Louis, Mo.	Wellington, Kans	Saint Louis, Mo.
Ruff's Dale, Pa	Pittsburg, Pa.	West Grove, Pa	Philadelphia, Pa.
Russellville, Ky		West Liberty, Ohio	Sandusky, Ohio.
Saint Albans, Vt	Albany, N. Y.	Westminster, Md	Washington City.
Salem, N. C		Weston, W. Va	Pittsburg, Pa.
Salina, Kans		Wilkes Barre, Pa	Philadelphia, Pa.
Sedalia, Mo		Wilmington, Del	Philadelphia, Pa.
Seneca Falls, N. Y		Wilmington, Ohio	Cincinnati, Ohio.
Seneca, Kans	Saint Louis, Mo.	Woodbine, Iowa	Chicago, Ill.
Shamokin, Pa		Wooster, Obio	Cleveland, Ohio,
Sharon, Pa	Pittsburg, Pa.	York, Pa	Washington City.

Total, 221.

Grand total of United States Signal Service stations and cities at which the cold-wave signal is displayed and warnings of approaching cold waves are telegraphed at the ex-

expense of the United States, 290.

In conclusion, I would state that information of the approach of each cold wave reaches fully 15,000,000 people through the display of the signal, the co-operation of railroad, telegraph, and telephone companies, and the publication of the warnings in all the leading newspapers of the country. It would be an endless task to attempt to enumerate all the benefits accruing to this large number of persons (very many of whom are engaged in business enterprises of great magnitude) by being forewarned from twenty-four to forty-eight hours of the approach of a sudden and decided fall in temperature. Sufficient data have been given in the body of this report to impress upon every one the importance and value of this work of the Signal Service, and it is hoped that future appropriations by Congress will be made upon such a liberal scale as will admit of the extension of this system to every town in the United States desirous of obtaining the information. Many citizens signified their willingness to purchase flags and display them at their own expense if the service would telegraph the warnings; but the appropriation available for this purpose during the pastseason was not sufficient to meet these demands.

I recommend that the sum of \$5,000, to be expended in the extension of the system of cold-wave warnings, be added to the estimates for the fiscal year ending June 30, 1888, to defray cost of telegraphing the warnings to the large number of persons desiring them and who will co-operate with this service by displaying the cold-wave signal at their own expense.

Very respectfully, your obedient servant,

F. R. DAY, ¿ Corps, U. S. Arma

# APPENDIX 5.

### REPORT ON WEATHER AND TEMPERATURE SIGNALS.

SIGNAL OFFICE, WAR DEPARTMENT, Washington City, June 30, 1886.

SIE: I have the honor to make the following report upon the work performed during the year ending June 30, 1886, in connection with the system of weather and temperature signals:

This system was inaugurated to meet the urgent demands of a very large number of persons in small cities for information of changes in weather and temperature.

The signals consist of six flags, not less than 6 feet square, of the following colors:



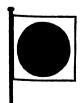
No. 1. White flag with large red sun in center, to indicate "higher temperature," or warmer weather.



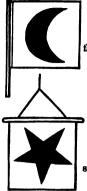
No. 2. White flag with red crescent in center, to indicate "lower temperature," or cooler weather.



No. 3. White flag with red star in center, to indicate "stationary temperature."



No. 4. White flag with large blue sun in center, to indicate "general rain (or snow)."



No. 5. White flag with blue crescent in center, to indicate "clear or fair weather."

No. 6. White flag with blue star in center, to indicate "local rain (or 8now)."

In displaying weather and temperature signals only two flags are hoisted at one time If more than one kind of weather or temperature is predicted, the last-named kind decides which flag to hoist.

The position of the flags in any hoist has no significance, as each flag designates a specific condition of weather or temperature in whatever position it may be placed.

During a calm, or when the wind is light, the signals cannot be readily distinguished if attached to the side of the staff, but when they are hung, as shown by the blue-star signal in the above cut, they are plainly visible during any velocity of wind.

The ''indications'' of the weather and temperature for the ensuing thirty-two hours are telegraphed daily by this office at 1 a. m., to stations of the Signal Service, and these "indications" are again telegraphed immediately by the observer to the towns within their respective districts, where the signals are displayed for the benefit of the public.

The telegrams are sent at the expense of the United States, but the flags are furnished by the persons by whom they are displayed. As a complete set of flags costs not less than \$13, and as these signals are daily displayed at three hundred and fifteen towns throughout the United States by public-spirited citizens, who have assumed this expense, and who send the information to surrounding towns where signals are displayed, making not less than one thousand places at which the display is made, there is no further testimony needed to prove the popularity and utility of the system.

On May 20, 1886, the following letter was sent to each person who displays these signals:

"DEAR SIR: This office being desirous of obtaining your opinion as to the value to your citizens of the weather and temperature signals, with a view to making needed corrections or additions to this important work of the Signal Service, I have the honor to request that you will answer, as far as practicable, the following questions:

'(1) Do the signals, as displayed, give satisfaction?

'(2) Can the signals, as displayed, be readily distinguished?

"(3) Have complaints been made as to the meaning of the flags; that is, is their mean-

ing perfectly intelligible?

"I should also be pleased to receive any suggestions as to any change which, in your view, would be an improvement; with the understanding, however, that no change will be made in the present system of symbols.

"I am, very respectfully, your obedient servant,

"W. B. HAZEN, "Brig. and Bot. Maj. Gen., Chief Signal Officer, U. S. Army."

"VEVAY, IND., May 25, 1886.

Two hundred and fifty replies were received to this communication, indicating that the weather and temperature signals give the greatest satisfaction to the inhabitants of the towns in which they are displayed. An example (given below) of the many letters received will serve to illustrate this fact:

"Gen. W. B. HAZEN,

"Chief Signal Officer, U.S. A.:

"SIR: I have the honor to acknowledge the receipt of your esteemed communication of the 20th instant in regard to the opinion and value placed by the public on the daily display of the weather and temperature signals at this station.

"In reply, I have the pleasure to inform you that not only the citizens at this station, but also those in the adjacent parts of the county and the opposite Ohio River county of Carroll, Kentucky, regard the daily display of the signals of the highest benefit, and are unanimous in their praise of the 'astonishing fulfillment' of the predictions. The community watch with eager'expectation every morning the display of the symbols and arrange their affairs accordingly. The merchants, mechanics, and farmers attest their fullest confidence in them, and rarely are they disappointed. During the past two stormy weeks much unnecessary work has been avoided by timely warning; indeed I can speak without hesitation of the universal confidence and appreciation by the public of this important branch of the Signal Service of the Army.

"In reply to the proposed questions, viz.:

"(1) Do the signals as displayed give satisfaction?—I have already answered in the affirmative in the introduction of this letter, but in addition would mention that even domestic duties are made dependent on the indications; there is scarcely a dwelling in this city without the symbol card and interpretation in a conspicuous place near the window commanding a view of the flag-staff.

"(2) Can the signals as displayed be readily distinguished?—Yes; they are visible in nearly every section of the city, suburbs, and shores on the Ohio River up and down stream; by the aid of a marine-glass or small telescope they appear plainly three miles back of the Ohio River in Kentucky, a privilege of which several prominent farmers avail themselves and impart the information to their neighbors; the captains of all pass-

ing steamers recognize the symbols.

(3) Have complaints been made as to the meaning of the flags, that is, is their meaning perfectly intelligible?—No complaint has been heard from any source whatever; the system of the symbols; their decidedly distinct character—red for temperature, blue for weather, operate so perfectly and has become so familiar that a substitution of any other device would have a tendency to confuse and impair for some length of time the object for their display.

'The children in our public schools are as familiar with the symbols and their inter-

pretation as they are with the alphabet.

"In my humble judgment any innovation in the present admirable code would, I fear, prove detrimental to the Signal Service of the Army. 

"Observer."

In addition to the system of flag-signals, symbols of the same shape, color, and meaning are used by a number of railroad companies for display from the sides of baggage CEIR.

The railway weather and temperature signals consist of seven symbols for indicating the changes in the weather and temperature, as follows:



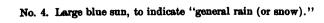
No. 1. Large red sun, to indicate "higher temperature," or warmer weather.



No. 2. Red crescent, to indicate "lower temperature," or colder weather.



No. 3. Red star, to indicate "stationary temperature."





No. 5. Blue crescent, to indicate "clear or fair weather."



No. 6. Blue star, to indicate "local rain (or snow)."



No. 7. Black square on white ground, to indicate the "approach of a cold wave."

The method adopted for the display of these symbols on railway trains is as follows: Seven tin, or sheet-iron, disks are made (in duplicate) each three feet square, and painted white. The proper symbols, as shown above, are painted on the disks, the symbol reaching to within six inches of the top and bottom. The disks are securely attached to each side of the baggage cars by means of cleats, or a slide, for holding three sides of These slides are long enough to admit two symbols, one above the other, one indicating the temperature and the other the weather. When warning is given of the approach of a cold wave, the cold-wave symbol takes the place of the temperature symbol.

The disks are in charge of the baggage-master, and he places them in position on the sides of the baggage cars when the "Indications" are received. They are changed at the

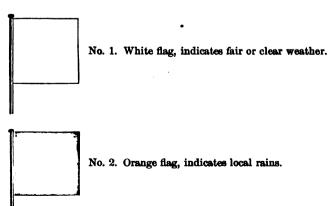
expiration of each twenty-four hours.

When the roads are long, running through two or more States, for each of which special predictions are made, the "Indications" are telegraphed by the railroad officials to selected points along the line of the road, and the symbols are changed by the baggagemasters to conform to the "Indications" for those States, respectively.

The system above outlined is simple and inexpensive. It is in successful operation on

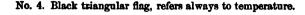
a number of railroads throughout the country, and is considered as being very effective in disseminating the information furnished by the United States Signal Service. A very large number of people receive the benefit of the weather forecasts in this way, who otherwise would not be able to obtain them.

The Alabama State Weather Service, which co-operates with the Signal Service, has adopted the system of weather and temperature signals given below. This system is very extensively used throughout the States of Alabama, Florida, Georgia, and Mississippi.





No. 3. Blue flag, indicates general rains.





No. 5. (United States Signal Service Cold-Wave Signal) white flag with black square in center, indicates the approach of a cold wave, i. e., a sudden and decided fall in temperature. This signal is usually ordered at least twenty-four hours in advance of the arrival of the cold-wave. It will not be displayed unless a temperature of forty-five degrees, or less, is expected.

Flag No. 4 (black triangular-shaped) by its position indicates the temperature to be expected. When displayed, it is either above or below the other flags. When placed above Nos. 1, 2, or 3 it indicates rising temperature, or warmer weather; when placed below flags Nos. 1, 2, or 3, as the case may be, it indicates falling temperature, or colder weather; its absence from the pole indicates stationary temperature (i. e., no material change from the temperature of the previous day).

#### EXAMPLES OF DISPLAYS.

If "cooler, fair weather" is predicted, flags 1 and 4 are hoisted with No. 1 uppermost. If "general rains and higher temperature" is predicted, then flags 3 and 4 are displayed, with No. 4 uppermost.

If "stationary temperature and general rains, followed by cooler, clear weather" is predicted, No. 3 is hoisted (with a space) and No. 1, with No. 4 below it.

When displayed on a flag-pole the signals are arranged so as to read downward.

The following is the list of towns at which the weather and temperature signals are displayed daily:

Towns.	Towns.	Towns.
Abilene, Kans.	Billings, Mo.	Carrollton, Mo.
Albany, N. Y.	Bloomfield, N. J.	Catekill, N. Y.
Allentown, Pa.	Blanchester, Ohio.	Carthage, Mo.
Arrow Rock, Mo.	Boonville, Mo.	Centralia, Ill.
Amsterdam, N. Y.	Bolivar, Mo.	Cedar Rapids, Iowa.
Asbury Park, N. J.	Bowling Green, Mo.	Champaign, Ill.
Ashland, Nebr.	Bordentown, N. J.	Chambersburg, Pa.
Ashley, lll.	Brookings, Dak.	Charleston, W. Va.
Athena Tana		
Athens, Tenn.	Bridgeport, Ill.	Charleston, Mo.
Attica, Kans.	Brunswick, Mo.	Chester, Ill.
Auburn, Ala.	Brownsville, Tenn.	Charlottesville, Va.
Austin, Tex.	Burbank, Ohio.	Chillicothe, Ill.
Auburn, Ind.	Bunker Hill, Ill.	Chetopa, Kans.
Bath, Me.	Butler, Ind.	Circleville, Ohio.
Bainbridge, Ga.	Burkesville, Ky.	Chillicothe, Ohio.
Beaver Dam, Wis.	Cambridge, Ohio.	Clarksville, Tenn.
Beatrice, Nebr.	Caldwell, Kans.	Clarksburg, W. Va.
Bellevue, Ohio.	Canandaigua, N. Y.	Clayton, N. Y.
Belleville, Ill.	Cameron, Mo.	Clay Centre, Kans.
Bethlehem, Pa.	Canton, Ohio.	Clinton, Mo.
Beloit, Kans.	Canton, Mo.	Clinton, Iowa.
Blair, Nebr.	Carterville, Mo.	Collinsville, Ill.

Towns.	Towns,	Towns.
bobden, Ill.	Johnston, N. Y.	Paris, Ill.
olumbia, Tenn.	Joplin, Mo.	Parkersburg, W. Va.
kolumbia, Mo.	Junction City, Kans.	Parsons, Kans.
olumbus, Nebr.	Juniata, Nebr.	Passaic, N. J.
olumbus, Ind.	Kendaliville, Ind.	Paterson, N. J.
lonneaut, Ohio.	Kennett Square, Pa. Kingston, N. Y.	Peabody, Kans.
olumbus, Ohio. Jorning, N. Y.	Kirksville, Mo.	Peoria, Ill. Pierce City, Mo.
onnellsville, Pa.	La Fayette, Ill.	Piqua, Ohio.
oshocton, Ohio. Jorsicana, Tex.	La Grange, Ind.	Pomeroy. Ohio.
orsicana, Tex.	Le Porte, Ind.	Pontiac, Mich.
rawfordsville, Ind.	La Salle, Ill.	Portsmouth, Ohio.
lovington, Va.	Latrobe, Pa. Laury's Station, Pa.	Princeton, Ind. Princeton, Ky.
lovington, Ohio. rete, Nebr.	Lewrenceburg, Ind.	Pulaski, Ill.
umberland, Md.	Lawrence, Kans.	Quincy, Mich.
Pallas, Tex.	Lebanon, Mo.	Richmond, Ind.
anville, Ill.	Leipsic, Ohio.	Richmond, Mo.
Payton, Ohio.	Lexington, Ky.	Richmond, Ky.
Decatur, Ill. Defiance, Ohio.	Lexington, Tenn. Lexington, Va.	Ripley, Ohio. Rochester, N. Y.
enison, Tex.	Ligonier, Ind.	Ruff's Dale, Pa.
ou Quoin, Ill.	Lincoln, Nebr.	Russellville, Ky.
ourham, W. C.	Lindsey, Ohio. Loudon, Tenn.	Saint Albans, Vt.
last Liverpool, Ohio.	Loudon, Tenn.	Saint Clairsville, Ohio
astman, Ga.	Louisville, Nebr.	Saint Joseph, Mo.
ast Tawas, Mich.	Ludington, Mich.	Selem, N. C.
aton, Ohio.'	Lyons, Iows.	Salina, Kana.
dinborough, Pa. dwardsville, Ill.	Madison, Ind. Malone, N. Y.	Sedalia, Mo.
Dorado, Kana.	Manchester. Ohio.	Seneca Falls, N. Y.
lk City, Kans.	Manchester, Ohio. Manistique, Mich.	Seneca, Kans.
Alsworth, Kans.	Manefield, Ohio.	Seymour, Ind.
mmeteburg, Iowa.	Marietta, Ohio.	Shamokin, Pa.
mporis, Kans.	Marshall, Mo.	Shanon, Pa.
vansville, Ind.	Mattoon, Ill. Maysville, Ky.	Shelbyville, Tenn.
airbury, Nebr. airfax, C. H., Va.	McConnellsville, Ohio,	Shreveport, La. Somerset, Pa.
alls City, Nebr.	McKeesport, Pa.	Southampton, N. Y.
ayetteville, Tenn.	Meadville, Pa.	Springfield, Tenn.
Andlay, Ohio.	Melvin, Ill.	Stanberry, Mo. Staunton, Va.
ond du Lac, Wis.	Miami, Mo.	Staunton, Va.
ort Atkinson, Wis.	Middletown, Va.	Steubenville, Ohio.
ort Mason, Fla.	Milan, Tenn. Minneapolis, Kans.	Steven's Point, Wis.
ort Worth, Tex.	Minneapolis, Minn.	Stromsburg, Nebr. Syracuse, N. Y.
remont, Ohio.	Moberly, Mo.	Talladega, Ala.
ultonham, Ohio.	Montpelier, Ohio.	Tamalco, Ill.
ultonville, N. Y. ainesville, Tex.	Montrose, Mo.	Taylorville, Ill.
ainesville, Tex.	Montrose, Pa.	Terre Haute, Ind.
alena, Kans.	Morristown, Ohio.	Texarkana, Tex. Thomasville, Ga.
allatin, Tenn. allipolis, Ohio.	Mount Carmel, Ill. Mount Pleasant, Pa.	Tidioute, Pa.
arrett, Ind.	Mount Vernon, Ind.	Tiffin, Ohio.
eneseo, Ill.	Mount Vernon, Ind. Mount Vernon, N. Y.	Toneka Kans
eneva, Ohio.	Mount Vernon, Ohio.	Tracy City, Tenn.
enesco, Ill. eneva, Ohio. boson City, Ill. loversville, N. Y.	May Massahorough Tenn	Tracy City, Tenn. Trenton, N. J. Trenton, Tenn. Union City, Tenn. Union City, Tenn.
loversville, N. Y.	Nebraska City, Nebr.	Trenton, Tenn.
rend Island, Nebr. reenville, S. C. Iagerstown, Md. Iamilton, Ohio. Iannibal, Mo.	Neillsville. Wis.	Union City, Tenn. Uniontown, Pa.
seerstown. Md.	Newark, N. J.	I Chichowii, Fa.
amilton, Ohio.	Newark, N. J. Newburg N. Y.	Urbana, Ohio, Utica, N. Y.
annibal, Mo.	Newcomerstown, Unio.	V 81QOSUS, US.
arlan, Iowa.	New Haven, Mo.	I VBDOBIBLIL
arian, Iowa. Iarper, Kana. Iastings, Mich.	New Middleton, Tenn.	Vevay, Ind.
lastings, Mich.	New Philadelphia, Ohio. New York City, N. Y.	Villa Ridge, III.
lazieton, Ind.	New York City, N. Y.	Vincennes, Ind.
lelena, Ark. lermann, Mo.	Norristown, Pa.	Washington, Mo. Washington, Pa.
illaborough. Ohio.	North Bangor, N. Y. Northville, N. Y.	Watseka, Ill.
obart, N. Y.	Odin, Ill.	Wauseon, Ohio.
oosick Falls, N. Y.	Oodenshare N V	Waynesborough, Va.
opkinsville, Ky.	Oil City, Pa.	West Grove, Pa.
ludson, N. Y.	Oil City, Pa. Olney, Ill. Osage City, Kans. Oshkosh, Wis.	West Liberty, Ohio. Weston, W. Va.
utchinson, Kans.	Osage City, Kans.	Weston, W. Va.
untington, W. Va.	Oshkosh, Wis,	Wheeling, W. Va. Wilkesbarre, Pa.
ndependence, Kans. owa City, Iowa.	I OKAWA. KADA.	Wilkesoarre, Pa. Wilmington, Del.
ronton, Ohio.	Owensborough, Ky. Oxford. Pa.	Wilmington, Ohio.
ackson, Mo.	Oyster Bay, L. I.	Woodbine, Iowa.
eckson, Tenn.	Paducah, Ky.	York, Nebr.
eckson, Tenn. ecksonville, Ill.	Palatka, Fla.	Youngstown, Ohio.
essup, Ga.	Palmyra, Mo.	Zanesville, Ohio.
ohnson City, Tenn.	Pana, Ill.	i ·

Over 1,500 communications on the subject of weather and temperature signals have been received and acted upon by this office during the year, and the display of the signals has been established in 315 towns since July 1, 1885. It is believed that fully 300,000 cards, containing the symbols in colors, with an explanation of their meaning, have been circulated by private enterprise in the towns wherein the signals are displayed. In the city of Bloomington, Ill., alone 40,000 cards were thus issued. It is estimated that several millions of people are daily informed of the coming changes

in weather and temperature through the medium of these signals.

The success attending the introduction of the system and the progress made during the year in establishing points of display, together with the fact that large sums of money have been expended by interested citizens in the purchase of flags and in providing means for their proper display, indicate the great interest manifested by the public in this class of Signal Service work.

I recommend that the sum of \$10,000 additional be included in the estimates for the fiscal year ending June 30, 1888, to pay the cost of telegraphing the "indications" to persons desirous of displaying these signals.

Very respectfully, your obedient servant,

F. R. DAY.

Second Lieutenant, Signal Corps, U. S. Army.

The CHIEF SIGNAL OFFICER OF THE ARMY, Washington, D. C.

#### APPENDIX 6.

### REPORT OF THE OFFICER IN CHARGE OF THE PACIFIC COAST DIVISION OF THE SIGNAL SERVICE.

SIGNAL OFFICE, DIVISION OF THE PACIFIC, San Francisco, Cal., July 10, 1886.

SIR: I have the honor to submit as my annual report the following operations of the Pacific coast division of the Signal Service from July 1, 1885, to June 30, 1886:

The work of this division includes:

(1) Forecasts of weather for next thirty-two hours, from noon and 8 p. m., Pacific

time, daily.

(2) Issuing of special bulletins at end of each month, giving a general synopsis of weather conditions and occurrences for the month then just past.

(3) Ordering cautionary signals at the designated ports from the northern to the southern boundary lines.

(4) Collection and dissemination of meteorological data of interest to the people of the

Pacific coast States. (5) Study of meteorology, especially of the Pacific coast, as will develop the work and

science to its greatest useful application to commerce and agriculture.

(6) Practice of military signaling.

The personnel of the division is shown in the accompanying Table I. It will be seen therefrom that I have but two clerical assistants, and one is only with me part of the time. I most urgently recommend that some distribution of the clerical force be made so as to equalize the work between this and other divisions or stations. Any man who makes scientific meteorology a study must depend largely upon tabulated data, and such tabulation requires clerical work, and sufficient force should be available as will allow the assistant in charge to devote his time to study of methods by which results and the laws regulating them are to be found. He should be the architect and builder of a scientific structure, without being forced to waste his energies as a simple carpenter.

The office remains in the very central and convenient place in the Western Union Telegraph Building. Its removal to the rooms set apart for the Signal Service in the custom-house building, and the consolidation with the observer's office, which is now separate, was recommended during the year. Such change, while a removal from the center of the city, would be a measure of economy to the extent of \$480 for rents alone per year when once effected. The service has at this place a creditable complement of turniture and facilities, making a good exhibit of Signal Service work. During the year and upon my request several self-registering instruments have been added to the display

of the office, giving attraction and instruction to visitors.

It has been said that it could hardly be hoped that as successful weather forecasts could be made for the Pacific as for the Atlantic coast, owing to changes always coming from the west, we having no frontier of observations. Table II of percentages, appended, obtained by applying rigidly the usual rules, shows the result of the work for each month. It has been observed that weather areas work up and down the coast, and when established they continue with considerable permanence. A paper with charts has been prepared by me giving a review of the weather for the past year, and certain weather types illustrating this feature of Pacific coast climate. An examination of the table will reveal some peculiarities as to the result of prediction, the most striking being the high percentages during the nearly rainless months of the summer and occasionally during the winter, notably during February, 1886. Special predictions have been made for forty-eight and sometimes more hours in advance, but in such cases the charts have shown peculiar permanent types. Such predictions are regarded perfectly safe under the circumstances, and it is during such periods that much good can be done for coast vessels by foretelling weather and wind.

These predictions would supply a demand of commerce that the cautionary signal system does not reach, and the result is susceptible of study and verification from vessel reports and also from observations made by the light-house service on the coast line. It is also, however, found that predictions for thirty-two hours are sometimes guess-work, as changes come so suddenly from an unobserved field, the ocean, that all view of the meteorological future is shut out. The element of winds on this coast is also an uncertain one, for topography and proximity to the ocean create as various winds as is the number of climatic districts; for instance, on the shore line sea breeze, in the Sacramento Valley southerly, in the San Joaquin Valley northerly winds blow at the same time. Such is the variety of locations and so constant are the winds at each that under a general prediction for a large area of country it is impossible oftentimes to include them; hence the advisability of prediction of wind in certain cases only. The prediction of changes in temperature appears uncertain and difficult on account of the absence of the successive march of high and low pressure areas, which are the usual phenomena that occasion such changes east of the Rocky Mountains.

Table III shows the distribution of the reports of this office, which includes all the important daily papers of this coast. A daily circulation of over 135,000 is shown.

The special monthly bulletin, giving a summary of temperature, monthly and seasonal rainfall, and other general notes, is issued, and published in the important papers of the State, and is a feature appreciated. This bulletin is deduced from data collected by telegraph from the Signal Service and railroad stations. A more complete system of reports for this purpose is not at the command of any other State in the Union. It was

commenced in January.

The introduction of the cautionary signal system has been well received. Table IV shows the number of days in which storms occurred, days with or without signals, and number of days signals were displayed without any storm. This statement shows the value of the work much better than considering the justification of each signal. However, the number of signals ordered during the year was 47, of which 41 were justified, making a percentage of 87.2 by the usual method of verification. This is considering as not justified those orders to the Puget Sound ports from which no reports were received. It should be observed that for many storms included in the statement, they occur during the summer months, and are improperly called "northwest trades," and for which no benefit would come by ordering signals. The supply of anemometers and self-registers is recommended for Astoria, Port Townsend, Seattle, and Tacoma, to enable this office to ascertain by recorded velocities the value of displays at Puget Sound ports.

As the experience gained by the assistant in charge of this division enables him to order signals with greater surety of success, and the service becomes better recognized thereby, new points of display should be added. The only place at present where an additional display station might be well established is at Port Harford—the port of San On account of San Luis Obispo office being burned April 19, I would advise the location of the new office at Port Harford, because of the signal display that might be made in connection with it there; besides, for climatological purposes, there are voluntary observers at San Luis Obispo that fill every requisite. Another station

would be of much service in the interior, near Lake Tulare.

As illustrating the work of the office and its advance, the accompanying Table V shows how many letters were received and sent; also number and kind of meteorological reports received. The apparent falling off during the months of May and June is largely due to the absence of rainfall, and which many voluntary observers consider the only element worthy of report. This statement covers only the current reports collected.

This division has collected and, since December, tabulated the rainfall from over two hundred stations, including voluntary, railroad, post surgeon, and Signal Service observa-tions. About the middle of each month, when all the reports have been received by mail, a tabulated statement has been issued and published by the papers, which has been favorably received. This State having so great a dependence upon the cereals, whose produce is largely governed by the amount and distribution of rain, its people watch closely and

receive with interest any matter that advances knowledge of this kind.

These monthly summaries were included in an annual statement prepared by this office, and published by the Commercial News July 1, 1886, showing the average minfall for each month of the year from about two hundred stations. This table did not, however, include many of the recently established places of observation and reports collected since June 30, which, if included, would swell the aggregate to about three hundred. To bring before the public this valuable data I have charted it nearly to completion, and should it be desired it can be printed, thus giving the Signal Service credit for the most complete publication of rainfall data ever collected for any single region in the United States.

A statement of the expenses during the year, exclusive of salaries, stationery, &c., is shown in Table VI. The economy practiced is evident, the telephone, post-office box, and janitor's services being discontinued. Economy has also been made by discontinuing from May to October certain telegraphic reports which, owing to location and uniformity of climate during the summer season, are not so essential as in winter. The scope of country covered by telegraphic reports received at this office and the manner of charting the same is shown by the four charts of 7 a. m., January 20, 1886. The severity of storms and the rapid fluctuations that sometimes occur on the Pacific coast may be gained from an examination of these charts and the consideration that a little over twenty-four hours after but two isobars could be traced on the chart from Vancouver to Mexico.

Scientific inquiry tending to the advancement of meteorology has thus far given way to the study of prediction of weather, which is deemed of first importance owing to its practical bearing, and the main object of the establishment of this division, however, besides the work of preparation of precipitation charts and tables, it is hoped during the summer to be able to collect data regarding and to discuss the "northers" of California, cause of low summer pressure in the interior, the advance of the rainy season along the coast, and frost and floods.

The subject of army signaling has not received attention, except a slight amount of office practice. Some failure to meet my requisition for the necessary signal equipments has operated to drop this work into neglect. It was intended during the long series of favorable summer days to practice occasionally as a means of out-door recreation.

It is sincerely hoped that the wishes expressed to me verbally by the Chief Signal Officer when I was ordered to this new and untried field of duty have been fully carried out and his expectations realized. Your expressed confidence in my ability and fitness to build up the Pacific coast division has given zest to my efforts, and I feel assured by the absence of any criticism, letters of instruction, or suggestion, that I have fully met with

your approbation.

The following extensions of the work would be of benefit to the interests of the Pacific coast, and in direct connection with its work; (a) study of the climate so as to insure a satisfactory warning of frosts; (b) the study of data looking to the establishment of such stations for the reporting of excessive rainfalls and sudden rises in the affluents of the great California rivers as to insure good results in forewarning overflows and floods, a thing now said to be impracticable; (c) the bringing into harmony with and use of the service of the meteorological system of the railroads which receive telegraphic reports daily from stations between El Paso, Tex., and the northern California line; (d) the establishment of stations for reporting tri-daily, located in the San Joaquin Valley, and at Port Harford; (e) the display of signals for the fishery interests at the mouth of the Columbia River; (f) the organization of a State weather service in co-operation with the Pacific division of the weather bureau for the extension and publication of valuable observations; (g) the correction of the exposure of many of the instruments which are now faulty; (h) extension of the extension system at smaller ports on the Pacific coast; (i) the extension of the prediction work to benefit vessels sailing along the coast; (j) establishment of a few stations in British Columbia along the line of the Canadian Pacific Railroad.

Respectfully submitted.

W. A. GLASSFORD,
Second Lieutenant, Signal Corps, U. S. Army, Assistant in Charge.
L. OFFICER OF THE ARMY

The CHIEF SIGNAL OFFICER OF THE ARMY, Washington, D. C.

TABLE I.—Statement showing names of persons on duty in connection with the Pacific Coast Division, rank, date, and nature of work.

Name.	Rank.	Date.	Order.	Remarks.
Robert Craig	1st Lt., 4th Art'y	July 1, 1885, to Sept. 30, 1885.	Nos. 2 and 205, A.G.O., 1885.	In charge.
W. A. Glassford*	2d Lt., Sig.Corps		No. 279, A. G. O., 1885	In charge.
Nelson Gorom	Sgt., Sig. Corps		Letter O. C. S. O., Sept 10, 1885.	In charge.
8. Applegate	do		S. O. 36, 1886, order of Sergeant Gorom.	Clerical assistant.
A. P. Leavitt	do		Letter O. C. S. O., July 10, 1885.	Clerical assistant.
B. S. Pague	Private, S. Corps		S. O. 9, 50, and 44, 1886,	Clerical assistant.
G. A. Riviere*	do	July 1, 1885, to June 30, 1886.	S. O. 9, 1885	Clerical assistant.
Nelson Gorom*	Sgt., Sig. Corps		Letter O.C.S.O. May 8, 1896.	Clerical assistant part of each day

^{· *}On duty on June 30, 1896,

TABLE II.—Percentage of verification of weather predictions.

	Nor	th Pa	eific.	Mid	dle Pa	cific.	Sou	th Pac	eific.		
	Weather.	Wind.	Temperature.	Weather.	Wind.	Temperature.	Weather.	Wind.	Temperature.	Average.	Person predicting.
1885. July	82.4 75.9 87.5 77.9 86.6 86.2 92.1 80.4	96.1 97.8 86.2 73.0 70.9 80.1 86.1 84.5 87.2 89.0 86.2	83.8 81.6 82.6 57.3 58.4 64.5 63.0 77.9 78.0 83.0 79.4 71.4	96.5 100.0 97.3 92.2 75.3 81.4 84.3 91.8 72.8 87.1 91.7 99.6	98. 2 98. 2 98. 3 70. 7 70. 1 68. 6 69. 0 75. 0 63. 4 69. 2 73. 7 86. 6	79.3 70.0 82.3 71.8 90.4 86.0 85.7	99. 1 95. 6 100. 0 97. 4 77. 0 88. 2 79. 8 89. 4 87. 5 95. 8 100. 0 99. 1	97.8 97.8 94.6 90.0 68.6 73.2 81.3 90.9 84.1 86.2 96.1 93.3	89.5 87.7 86.2 86.6 84.8 76.9 78.4 88.0 81.5 80.8 81.1 83.1	92.0 92.1 88.5 79.7 73.4 75.8 77.2 85.2 79.3 84.3 87.8 86.2	Lieut. Robert Craig, assistant, July 1 to September 25, 1885.  Sgt. N. Gorom, Sept. 25 to Dec. 23, 1885, except suspended from Nov. 28 to Dec. 2.

TABLE III.—Table showing the distribution of the weather forecasts on the Pacific coast.

Abend Post*	Number of manifold bulleting.	Paper or person receiving indications.	Place.	Circulation.	Remarks.
Evening Post.	1	_	ŀ		
Evening Post	1	Abend Post*	do	2,500	Indications for California dur-
Daily Report*	1	Evening Post	do	12,500	Do.
Daily Examiner	1	Daily Reports	do	,000	Indications for California
Daily Examiner	ī	San Francisco Chroniclet	40	97 500	Do Do
Daily Examiner†   do   10,000   10,000   10,000   10,000   10,000   10,000   10,000   10,000   10,000   10,000   10,000   10,000   10,000   10,000   10,000   10,000   10,000   10,000   10,000   10,000   10,000   10,000   10,000   10,000   10,000   10,000   10,000   10,000   10,000   10,000   10,000   10,000   10,000   10,000   10,000   10,000   10,000   10,000   10,000   10,000   10,000   10,000   10,000   10,000   10,000   10,000   10,000   10,000   10,000   10,000   10,000   10,000   10,000   10,000   10,000   10,000   10,000   10,000   10,000   10,000   10,000   10,000   10,000   10,000   10,000   10,000   10,000   10,000   10,000   10,000   10,000   10,000   10,000   10,000   10,000   10,000   10,000   10,000   10,000   10,000   10,000   10,000   10,000   10,000   10,000   10,000   10,000   10,000   10,000   10,000   10,000   10,000   10,000   10,000   10,000   10,000   10,000   10,000   10,000   10,000   10,000   10,000   10,000   10,000   10,000   10,000   10,000   10,000   10,000   10,000   10,000   10,000   10,000   10,000   10,000   10,000   10,000   10,000   10,000   10,000   10,000   10,000   10,000   10,000   10,000   10,000   10,000   10,000   10,000   10,000   10,000   10,000   10,000   10,000   10,000   10,000   10,000   10,000   10,000   10,000   10,000   10,000   10,000   10,000   10,000   10,000   10,000   10,000   10,000   10,000   10,000   10,000   10,000   10,000   10,000   10,000   10,000   10,000   10,000   10,000   10,000   10,000   10,000   10,000   10,000   10,000   10,000   10,000   10,000   10,000   10,000   10,000   10,000   10,000   10,000   10,000   10,000   10,000   10,000   10,000   10,000   10,000   10,000   10,000   10,000   10,000   10,000   10,000   10,000   10,000   10,000   10,000   10,000   10,000   10,000   10,000   10,000   10,000   10,000   10,000   10,000   10,000   10,000   10,000   10,000   10,000   10,000   10,000   10,000   10,000   10,000   10,000   10,000   10,000   10,000   10,000   10,000   10,000   10,000   10,000   10,000   10,000   10,000   10,000   10,00	î	Morning Call	uo	07,000	
Daily Examiner†	- :	Morning Cuit		20,000	
Der Demokrat†	_			'	plete.
Le Courrier de San Francisco, † The Guide†	_				ing rainy season.
Cisco.† The Guidet	_	·			California during rainy season.
Commercial News	1	cisco.†		• • • • • • • • • • • • • • • • • • • •	ing rainy season.
Commercial News	I	The Guide†	do		Indications of weather.
1   Journal of Commerces	1	Commercial Newst	do		Indications Pacific coast.
Western Union Telegraph Company.   1	1	Journal of Commercet	do	750	
Western Union Telegraph Company.   Associated Press.	1	Observer's office	do	146	Complete farmers' bulletin
Associated Press.	1				Posted on bulletin board.
San Diegan	1	Associated Press	do		Telegraphed to papers and places named.
San Diegan		Surf	Santa Cruz		Indications of weather.
San Diegan		Press	Santa Barbara	500	Do.
San Diegan		Independent	do	500	Do
San Diegan		Mercury	San Josá	2 000	Do
San Diegan		Independent	Stockton	1 600	Do.
San Diegan		Warn ld	Too America	1,000	D0.
San Diegan		The and	DOS VIIRGIGS	1,000	μο.
San Diegan		1 mes		2,000	До.
San Diegan		Express	do	1,500	Do.
Union		Bun	San Diego	250	
Union		San Diegan	do		Do.
News					Do.
Post-Intelligencerdo		Record Union	Sacramento	4,000	
Post-Intelligencerdo		News	Modesto	7,500	
Post-Intelligencerdo		Evnoritor	From C	950	
Post-Intelligencerdo		Warnia - One-paid	Presio	4 000	
Post-Intelligencerdo		acoung Oregonian	Fortiand	4,000	
Post-Intelligencerdo		Louger	1200ma	200	
Post-Intelligencerdo		Vems	do	500	
Post-Intelligencerdo					
Total 135, 397		Post-Intelligencer	do	1,000	, Do.
		Total		135, 397	

[•] Evening.

TABLE IV.—Table showing the number of days storms occurred at each station, with the number of cautionary signals displayed, &c.

1885-'86.	8	an I	Dieg	о.	Sa	n Fra	anci	sco.	F	ort (	Cant	<b>оу.</b> ́		Ast	oria.	•	Olympia.			
Month.	Number.	With signals,	Without signals.	Signals without storm.	Number.	With signals.	Without signals.	Signals without storm.	Number.	With signals.	Without signals.	Signals without storm.	Number.	With signals.	Without signals.	Signals without storm.	Number.	With signals.	Without signals.	Signals without
July			1 2 2 6		15 18 15 3 3  7 1 2 3 1 7	5	15 18 15 3 3 2 1 2 3 1 7		2 7 9 23 20 17 13 13 7 1	10 3	2 7 9 23 20 7 10 13 6 1	3	1 1 9 11 3 2 1	10 4	1 1 2 1 1 8 1 1	3	2  1 3		1 8	
188	5-'86		-			Tac	oma	<del>'</del>		Seat	tle.	,	P	ort T	owi	18-	Po	rt A	ngel	
Mo	nth.				Number.	With signals.	Without signals.	Signals without storm.	Number.	With signals.	Without signals.	Signals without storm.	Number.	With signals.	Without signals.	Signals without storm.	Number.	With signals.	Without signals.	Signals without storm.
July	•••••			•••••	·····				1	1		2 1	3 1	3 1			11 2	9 1	2 1	1

NOTE.—From July 1 to April 30 a velocity of 25 miles per hour is considered as a storm, and since May 1 the verifying velocities at different stations have been used, 4. c., San Diego, 20 miles; San Francisco, 30 miles; Fort Canby, 35 miles; Olympia, 13 miles, and Port Angeles, 21 miles. Astoria, Tacoma, Scattle, and Port Townsend have no anemometers.

TABLE V.—Showing letters sent and received, meteorological forms from Signal Service, surgeons, railroad and voluntary observers.

1885-'86.	Lette	rs.		Meteorological reports received.										
Months.	Received.	Sent.	Signal Service.	Voluntary Observers.	S. P. R. R. C.	Post surgeon.	Light-House Department.							
 July	143	143	63	4	121	11								
August	123	185	62	7	121	12								
September		183	63	12	121	11								
October	78	63	61	19	122	10								
November		36	62	24	124	10								
December		35	53	23	126	10								
January	33	36	63	34	128	11								
February	. 57	116	64	34	128	12								
March		85	64	70	127	12								
April	69	313	59	67	127	12								
May	49	109	58	40	123	12								
June*	33	84	43	26	115	12								
Total	793	1,387	715	360	1,483	135	5							

^{*} Reports received to July 10.

Table VI.—Annual expenses at branch signal office, division of the Pacific, during fiscal year ending June 30, 1886.

Items of expense.	Amount.	Remarks.
Rent, office.  Washing towels.  Gas fixtures and chimneys  Rent of telephone  Office cleaner  Rent of post-office box  Gas for office  Cosl and kiydling wood	42 00 48 00 9 00 14 70 24 00	\$20 per month. 50 cents per month. \$6 per month, from May 4, 1885, to March 31, 1886. \$6 per month, from July 1, 1885, to February 28, 1886. \$3 per quarter, from July 1, 1885, to March 31, 1886.
Office supplies Total	13 65 423 85	Soap, ink (red), copying ink, stamps, oil, lamps.

Table showing monthly rainfall averages (expressed in inches and hundredths) in California, Oregon, and Washington Territory, with mean averages for season, number of years from which averages are determined, and total for season of 1885 and 1886.

[Compiled by Lieut, W. A. Glassford, Signal Corps, U. S. A., in charge Pacific Coast Division.]

Place and State.	Years of record.	July.	August.	September.	October.	November.	December.	January.	February.	March.	April.	May.	June.	Average for season.	Total for sea son 1885-'86.
Taloosh Island, Wash	3							14.87							101.58
Simiahmoo, Wash	1					2.57		5.61	2.68	4.10	2.13	1.84	1.42	33,62	
Neah Bay, Wash San Juan Island, Wash	9					3, 98									108, 35
Port Angeles, Wash	2				3.34				3.75				1,21	28, 34	
Fort Bellingham, Wash	40				3, 34					3,52					27.88
Blakely, Wash	9				4, 07								1,72	46, 39	
Tacoma, Wash	i					8, 22									*******
Fort Steilacoom, Wash,	12				2, 85			6,09						38, 92	
Fort Colville, Wash		1.07			.51									14,06	
Fort Simcoe, Wash	2												0, 26		
Pleasant Grove, Wash	- 4				. 47								,60		8,26
Fort Townsend, Wash	14				1.45		2,30							19, 33	
Olympia, Wash,	1	. 86				9, 19								58,01	
Walla Walla, Wash		. 47						1.88		1,44	1.61	2,06	1.31	16,82	12.97
CapeDisappointment, Wash		2,64	. 28	2.56	5, 92	11,98	41,79	10.02	8.03	8, 11	4,95	1,91	3,05	71,24	

# Table showing monthly rainfall averages, &c.—Continued.

Place and State.	Years of record	July.	August.	September.	October.	November.	December,	January.	February.	March.	April.	May.	June.	Average for season,	Total for sea- son 1885-'86.
Port Canby, Wash. Cathlamet, Wash. Cathlamet, Wash. Fort Yamhill, Oreg. Cascades, Oreg. Fort Stevens, Oreg. Fort Stevens, Oreg. Astoria, Oreg. Fort Vancouver, Wash. Portland, Oreg. Spokane Falls, Oreg. Dalles, Oreg. Umatilla, Oreg. Fort Hoskins, Oreg. Roseburg, Oreg. Roseburg, Oreg. Fort Orford, Oreg. Bandon, Oreg. Umpqua, Oreg. Oregon City, Oreg. Ashland, Oreg. Camp Watson, Oreg. Linkville, Oreg. Camp Harney, Oreg. Lakeview, Oreg. Camp Harney, Oreg. Albany, Oreg. Camp Lincoln, Oreg. Crescent City, Cal Yreka, Cal. Fort Jones, Cal. Fort Jones, Cal. Fort Gaston, Cal Blue Lake, Cal. Camp Wright, Cal Humbold Light-house, Cal Hydesville, Cal Umder, Cal Redding, Cal Redding, Cal Redding, Cal Red Bluff, Cal Tehama, Cal Chico, Cal. Red Bluff, Cal	23 17 15	.60 .36 .47 2.03 1.20 1.32 1.05 .32 .37	1. 60 . 422 . 94 . 52 . 02 1. 488 . 52 . 27 . 34 . 35 . 35 . 35 . 35 . 00 . 00 . 00 . 81 . 10 . 65 . 68 . 13 . 10 . 10 . 10 . 10 . 10 . 10 . 10 . 10	2, 69 5, 65 2, 39 3, 59 1, 65 1, 87 1, 47 1, 46 3, 18 3, 18 2, 43 2, 27 2, 26 2, 26 3, 30 3, 40 43 43 43 43 44 43 44 44 45 46 46 47 47 48 48 48 48 48 48 48 48 48 48 48 48 48	4.68 5.23 4.65 2.465 2.465 2.465 2.465 2.465 2.465 2.465 2.465 2.465 2.465 2.465 2.465 2.465 2.465 2.465 2.465 2.465 2.465 2.465 2.465 2.465 2.465 2.465 2.465 2.465 2.465 2.465 2.465 2.465 2.465 2.465 2.465 2.465 2.465 2.465 2.465 2.465 2.465 2.465 2.465 2.465 2.465 2.465 2.465 2.465 2.465 2.465 2.465 2.465 2.465 2.465 2.465 2.465 2.465 2.465 2.465 2.465 2.465 2.465 2.465 2.465 2.465 2.465 2.465 2.465 2.465 2.465 2.465 2.465 2.465 2.465 2.465 2.465 2.465 2.465 2.465 2.465 2.465 2.465 2.465 2.465 2.465 2.465 2.465 2.465 2.465 2.465 2.465 2.465 2.465 2.465 2.465 2.465 2.465 2.465 2.465 2.465 2.465 2.465 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10.21 10.21 10.21 10.21 10.21 10.21 10.21 10.21 10.21 10.21 10.21 10.21 10.21 10.21 10.21 10.21 10.21 10.21 10.21 10.21 10.21 10.21 10.21 10.21 10.21 10.21 10.21 10.21 10.21 10.21 10.21 10.21 10.21 10.21 10.21 10.21 10.21 10.21 10.21 10.21 10.21 10.21 10.21 10.21 10.21 10.21 10.21 10.21 10.21 10.21 10.21 10.21 10.21 10.21 10.21 10.21 10.21 10.21 10.21 10.21 10.21 10.21 10.21 10.21 10.21 10.21 10.21 10.21 10.21 10.21 10.21 10.21 10.21 10.21 10.21 10.21 10.21 10.21 10.21 10.21 10.21 10.21 10.21 10.21 10.21 10.21 10.21 10.21 10.21 10.21 10.21 10.21 10.21 10.21 10.21 10.21 10.21 10.21 10.21 10.21 10.21 10.21 10.21 10.21 10.21 10.21 10.21 10.21 10.21 10.21 10.21 10.21 10.21 10.21 10.21 10.21 10.21 10.21 10.21 10.21 10.21 10.21 10.21 10.21 10.21 10.21 10.21 10.21 10.21 10.21 10.21 10.21 10.21 10.21 10.21 10.21 10.21 10.21 10.21 10.21 10.21 10.21 10.21 10.21 10.21 10.21 10.21 10.21 10.21 10.21 10.21 10.21 10.21 10.21 10.21 10.21 10.21 10.21 10.21 10.21 10.21 10.21 10.21 10.21 10.21 10.21 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1.35 1.35 1.35 1.35 1.35 1.35 1.35 1.35 1.35 1.35 1.35 1.35 1.35 1.35 1.35 1.35 1.35 1.35 1.35 1.35 1.35 1.35 1.35 1.35 1.35 1.35 1.35 1.35 1.35 1.35 1.35 1.35 1.35 1.35 1.35 1.35 1.35 1.35 1.35 1.35 1.35 1.35 1.35 1.35 1.35 1.35 1.35 1.35 1.35 1.35 1.35 1.35 1.35 1.35 1.35 1.35 1.35 1.35 1.35 1.35 1.35 1.35 1.35 1.35 1.35 1.35 1.35 1.35 1.35 1.35 1.35 1.35 1.35 1.35 1.35 1.35 1.35 1.35 1.35 1.35 1.35 1.35 1.35 1.35 1.35 1.35 1.35 1.35 1.35 1.35 1.35 1.35 1.35 1.35 1.35 1.35 1.35 1.35 1.35 1.35 1.35 1.35 1.35 1.35 1.35 1.35 1.35 1.35 1.35 1.35 1.35 1.35 1.35 1.35 1.35 1.35 1.35	53, 285, 286, 286, 286, 286, 286, 286, 286, 286	64.88 41.2 35.99 67 10 25.60 17.77 17.33 40.53 30.95 23.00
Meadow Valley (Silver Creek), Cal. Orland, Cal. Willows, Cal. Princeton, Cal. Cantelope Valley, Cal. Colusa, Cal. Williams, Cal. College City, Cal. Westport, Cal. Point Arena, Cal. Laytonville, Cal. Laytonville, Cal. Camp Far West, Cal Grass Valley, Cal. West Butte, Cal. Camp Far West, Cal. Camp Far West, Cal. Grass Valley, Cal. West Butte, Cal. Nicolaus, Cal. Emigrant Gap, Cal. Emigrant Gap, Cal. Colfax, Cal. Auburn, Cal. Georgetown, Cal. Placerville, Cal. Shingle Springs, Cal. Folsom, Cal. Sacramento, Cal. Brighton, Cal. Gal. Gal. Gal. Gal. Gal. Gal. Gal. G	3 8 13 9 15 9 3 3 2 2 8 3 100 166 2 2 144 7 7 8 9 9 16 16 16 14 11 11 19 15 37 9 9	2.40 .00 .00 .09 .01 .00 .01 .00 .00 .01 .00 .00	.000 .011 .099 .002 .011 .000 .000 .001 .010 .000 .001 .000 .000 .001 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000 .000	.41 .18 .23 .25 .19 .19 .17 .37 .17 .30 .34 .48 .48 .22 .15 .69 .32 .54 .20 .42 .42 .42 .42 .42 .42 .42 .42	.80 1, 10 54 1, 04 49 .80 1, 67 1, 37 1, 06 1, 43 1, 19 66 2, 81 1, 19 66 41 1, 83 1, 19 1, 83 1, 19 1, 83 1, 19 1, 83 1, 19 1, 83 1, 83 1	3, 48 5, 54 4, 02 2, 18 6, 50 5, 94 4, 46 2, 63 2, 16 1, 41	2, 45 2, 67 3, 17 2, 68 4, 92 3, 17 7, 50 6, 12 3, 43 4, 87 7, 50 6, 21 3, 43 4, 87 7, 50 6, 21 3, 43 4, 87 7, 50 6, 21 3, 68 6, 90 7, 7, 50 6, 12 4, 7, 7, 80 7, 7, 80 7, 7, 80 8, 7, 7, 80 8, 80 8	2,50 4,06 3,04 10,42 8,65 6,39 4,25 (1,53 9,10 7,72 4,48 3,84 2,96	6, 40 4, 78 2, 74 8, 00 4, 38 3, 71 3, 28 2, 81 2, 12	4, 67 3 2, 61 9 9, 23 7 6, 34 6 5, 14 3 3, 06 2 2, 91 1 2, 50 3	1. 59 1. 80 1. 80 1. 52 1. 54 1. 62 1. 54 1. 62 1. 62 1. 64 1. 89 1. 62 2. 23 3. 52 1. 64 1. 62 2. 23 3. 52 3. 52 5. 61 5. 61 5. 55 5. 56 61 62 62 63 63 63 63 63 63 63 63 63 63	,56 ,39 ,55 ,82 ,48 ,53 ,08 ,1,32 ,76 ,98 ,60 ,04 ,85 ,62 ,62 ,70 ,70 ,70 ,71 ,71 ,71 ,71 ,73 ,73 ,74 ,74 ,74 ,75 ,76 ,76 ,76 ,76 ,76 ,76 ,76 ,76 ,76 ,76	.777 .166 .455 .241 .377 .411 .144 .322 .300 .344 .122 .311 .000 .344 .566 .311 .233 .811 .199 .266 .13	13, 08 15, 36 35, 54 28, 11 37, 61 32, 92 16, 69 20, 60	24, 08 68, 42 51, 01 42, 31 27, 81 73, 02 54, 13 42, 08 35, 04 32, 27 19, 35

# REPORT OF THE CHIEF SIGNAL OFFICER.

## Total showing monthly rainfall averages, &c.—Continued.

Place and State.	Years of record.	July.	August.	September,	October.	November.	December.	January.	February.	March.	April.	May	June.	Average for season.	Total for sea- son 1885-'86.
Woodland, Cal	14 15	.01	.00	.10	.89	1,86	3, 10 3, 80	3,55 3,37	2, 24 2, 01	2.17	1.86 1.72	.58	.23	16.59 15.94	22, 84 24, 50
Denverton, Cal	13	. 01	.00	.15	.96	2,59	2,58	4.33	2, 29	2,53	1.87	.56	. 29	18.16	23, 76
		.00	00	.30	1,43	3.71	8,85	5, 85	2, 86	3,91	5, 35	1, 13	.00	33, 39	37.08
Suisun, Cal	15	.06	(*)	.18	.91	2.14	4,87	4.43	2.53	2.42	1.74	. 56	. 26	20.10	
South Vallejo, Cal	30	.00	.00	.11	. 64	1,59	3, 12	3, 42 3, 23	2.17	2.37	2,46	6,01	. 21	16, 82 15, 97	26, 16 28, 16
Suisun, Cal	14	.00	.00	95	1.98	$\frac{1.87}{3.73}$	5.34	7.62	2,11	4.48	1,68	.85	.33	33, 16	
Nepa, Cal	10	.00	.00	. 53	.07	2.32	3,72	5.70	3, 12	3, 10	2.97	. 82	.30	22,70	28, 22
Napa, Cal. Petaluma, Cal. Point Reyes, Cal. Sin Rafael, Cal.	15	.00	. 00	. 09	1.03	2,68	4.50	4,99	3,38	2, 62	2, 15		.31	22, 32	29,07
Point Reyes, Cal.	11	.00	.00	.08	.54	9 25	2.77	3,27	2.75		2,05		, 22	16.93	
San Rafael, Cal. Saucelito, Cal. Point Bonita, Cal. Angel Island, Cal. Alestras Island, Cal. Pesidio, Cal. Fort Mason, Cal. San Francisco, Cal. South Farrallone Island,	12		.00	.34	2,30 1,65	4.68	7.03 5.13	8, 64 3, 91	4,96	5, 45	3, 71	1.19	.40	38, 98 20, 21	41, 45 22, 53
Point Bouita, Cal	11	.04	.00	25	1.70	4. 21 3. 15	3,73	5.04	3, 83	3, 89	2,94	. 97	.39	25. 93	29,55
Angel Island, Cal	18	.00	.00	, 15	1 677	2,73	4, 32	4, 70	2,98	2, 81	2,36	.49	. 24	21.85	31,76
Alestraz Island, Cal	21	.00	.01	.08		1,96	3.74	4,01	2,86	2,00	1,42	.40	, 18	17.27	27, 27
Presidio, Cal	32 13	.12	.00	.09		2,22	4.33	3, 96	3.11	2.63	1, 85	.51	. 30	19.74 16,42	27, 48
San Francisco Cal	37	.01	.00	.17	.88	3,04	5.34	5.18	3,61	2, 01 3, 18	2.04	.63	. 15	24, 25	28, 36 33, 05
South Farrallone Island,	0,					0,03	0.01	0.10	5, 61	0.10	2.0.	. 00	. 10		30,00
		.00	.00	.18	1,05	2,52	3,54	2.97	2.10	2,35	2, 23	.74	.50	18.18	26, 15
Yerba Buena Island, Cal	8	.00	. 00	. 27	. 92	2, 12	3.49	2.71	1,91	2,62	2,58	.55	.34	17.51	20, 12
Brentwood Cal	7	.00	.00	.11	.60	1,87	3, 15 2, 11	2.88	2, 27	1.76	2,49	.56	. 25	17.10 $11.26$	23,06 $16,76$
Eyron Cal	7	.00	.00	(*)	.51	1.63	2,43	2, 32	1.19	2,07	2 10	.37	99	12, 84	16, 92
Antioch, Cal	- 8	.00	.00	0.4	53	1,33	2.26	2.30	1,23	1.84	1,52	.47	. 18	11.70	13, 25
Stockton, Cal	16		.00	.06	. 58	1,28	2,94	2.54	2,00	1,94	1,44	. 64	.11	13,54	********
Tenne Cal	9 16	.02	.00	.01	.44	1.32	1.79	2.18	1.77	1.70 $1.29$	1,89	. 63	.16	9, 10	14.53
Farmington Cal	10		.00	.15	77	1, 43	2.42	$\frac{1.74}{2.74}$	1.34	2, 40	9 50	. 63	.16	15, 57	12.30 20.00
Ione, Cal	9	.00	.00	. 15	.98	1, 93	2.99	3, 11	2.84	3, 23	3, 61	.89	133	20,06	25.14
Jackson, Cal	9	.00	- 00	.42	1 66	3,04	4.86	5.18	4.69	4.88		1,39	.32	31,61	
Modesto, Cal	16	.00	(*)	.12	.53	1,46	1.67	1,75	1.15	1.24	1, 13		, 12	9, 53	12, 85
Onkland Cal	9	.00	.00	. 04	.57	$\frac{1.73}{2.33}$	1.37 2.93	1.35	1, 25	1.38	9 73	, 46	. 26	10,26 $20,96$	26.75
Yerba Buena Island, Cal Martinez, Cal Berniwood, Cal Byron, Cal Byron, Cal Antioch, Cal Stockton, Cal Lathrop, Cal Farmington, Cal Jackson, Cal Jackson, Cal Jackson, Cal Jackson, Cal Jackson, Cal Modesto, Cal Oakland, Cal Oikland, Cal Oikland, Cal Oikland, Cal Niles, Cal	13	.02	. 02	. 24	1 43	3,18	4.13	5.10	3.09	3, 62	2, 48	77	. 49	24.57	20. 10
Niles, Cal	16	. 00	.00	.08	. 83	2,27	3, 36	3,20	2,62	2, 25	1,70	.55	25	17, 11	23, 93
Pleasanton, Cal	9	.00	. 01	.06	.77	1.59	2,85	3.31	2.70	3, 21	2.50	. 64	. 25	17, 92	18.90
Point Montage Col	16	(*)	.00	.06	1,10	1.62 3.29	2.79 4.79	2.62	2.31 $2.41$	1.98 3.80	7 97	1.02	.45	13.91 $24.39$	16,79 $28,41$
San Mateo, Cal	13	.00	.00	.11	1,01	2, 24	3, 11	4.24	2,47	2,80	2	.50	32	19, 03	22, 85
Menio Park, Cal	9	.00	(*)	.03	. 66	1.48	2.99	2,74	1.54	2,41	2.35	.51	.38	15, 09	18.91
Ano Nuevo light-house,		000	no.	or	1 00	0.00	F 10	0.00	à 11	0.10			100		
Pigeon Point Herbt-house	8	.09	,00	. 25	1.06	2, 32	5, 19	3.05	2, 40	3.13	3, 41	. 94	.40	22, 24	23, 31
California	8	. 01	.00	.18	.80	1.79	3, 17	2.39	1.93	2.12	3, 31	1.01	.26	16, 97	18,36
San José, Cal	13	,00	.00	.05	. 68	1.29	1.87	2,63	1.85	9.23	1.65	.37	-21	12,83	20, 63
Gilroy, Cal	13	. 00	.01	. 20	1.02	2.28	3.16	4.62	3.02	-2.011	2.05	. 43	, 16	19,86	21,34
Santa Crear Cal	2	.09	.00	41	.78 1.35	5.32	7.58	5, 24 5, 09	3,75	$\frac{2.26}{3.56}$	9. 64	.20	.40	26, 60 25, 88	34.85
Niles, Cal  Niles, Cal  Pleasanton, Ca I  Livermore, Cal  Point Montarn, Cal  San Mateo, Cal  Menio Park, Cal  Ano Noevo light-house, California  Pigeon Point light-house, California  Gilroy, Cal  Aptos, Cal  Aptos, Cal  Aptos, Cal  Santa Cruz, Cal  Pajaro, Cal  Fort Milber, Cal  Fort Milber, Cal	13	.01	.01	12	1,16	2.13	3.08	4.33	2.68	2 82	1.84	50	21	18, 89	$\frac{32.75}{27.18}$
Watsouville, Cal	2	.00	.00	.10	1 17	1.75	7.43	4,85	# 74	9 14	1.76	-50	.00	24.52	and the same
Fort Miller, Cal	7	.00	.00	.03	,28	2,63	5.40	1.65	1.76	4, 29	1.91	1.00	.00	19,00	*******
Central Point Cal	14	.00	,00	.09	. 45	1,31	1.73	2.36 1.52	1,31	1.61 $1.85$	1.52	.46	.21	11,09	14, 43 15, 47
Borden, Cal	12	.02	.00	.01	.34	1, 26	1.31	1.57	1.05	1.42	T 303	.37	20	9.75	18, 27
Firebaugh's Ferry, Cal	14	.00	.00	. 07	.31	1.51	1.28	1.78	1.11	1.12	. 94	. 16	. 17	8.46	18,84
Fresno, Cal	9	,00	.00	.09	.40	1.26	1.38	1.41	1.14				. 14	9,57	16,62
Hollister Cal	13	,00	.00	.08	, 36	1.13	$1.97 \\ 1.57$	$\frac{1.21}{2.58}$	$\frac{1.21}{1.72}$	1.34	1,59	.39	. 12	9,36	14.52 $14.87$
Salinas Cal	13	.01	. 01	,08	. 75	1.33	1.82	3.18	2.17	2.19	1.55	.34	25	13, 75	20, 32
Monterey, Cal	10	.04	.01	. 05	. 62	1.52	2.71	2.10	1.88	3.31	2.04	. 45	223	14,96	19.12
Watsonville, Cal. Port Miller, Cal. Merced, Cal. Merced, Cal. Central Point, Cal. Rorden, Cal. Prebaugh's Ferry, Cal. Presauch's Ferry, Cal. Presauch's Ferry, Cal. Rollister, Cal. Salinas, Cal. Monterey, Cal. Chualar, Cal. Bishop Creek, Cal. Camp Independence, Cal. Receler, Cal. Visalia, Cal. Goshen, Cal. Utaria, Cal. Utaria, Cal. Utaria, Cal. Utaria, Cal.	. 9	.01	,00	, 06	5.94	1.64	1.82	2.78	2, 41	2:47	1.48	.40	. 20	14.21	16.27
Bishop Crook Cal	13	.00	, 01	.00	.30	1,08	1.13	2.16		1.67	.78	. 26 . 72	.13	8.94	14.70
Camp Independence, Cal	8	.11	. 20	.06	38	.18	2.70	1.18	. 66	.54	900	98	.00	6,60	. 62
Keeler, Cal	3	.00	. 16	.00	.12	. 33	. 53	.24	. 42	.51	.47	53	.27	3,78	2,90
Visalia, Cal	- 8	12)	.00	.04	.50	1,02	1,86	1.34	1.45	1.23	1,64	, 30	.01	9, 39	13.10
Tulare Cal	10	.00	,00	05	.32	. 80	1.53	1.07	1.25	1.16	1,23	. 15	.09	7.74	10.62
Hanford, Cal.	7	,00	10,	.01	1.45	.59	1,09	1.41	1,17	1,91	1.69	.24	, 10	6, 89 12, 40	9.25
Lemoore, Cal	8	.00	.00	.03	. 33	1,45	2, 11	1,87	1.05	1.20	1,42	. 16	. 20	9,82	17.31
User, Cal.  Ulare, Cal.  Hanford, Cal.  Lemsore, Cal.  San Luís Obispo, Cal.  Jelano, Cal.  Romner, Cal.	17	.02	,00	.03	.72	2,03	4.76	4,68	3, 75	2.81	2.05	. 35	. 14	21.34	29,59
Remo, Cal	12	.00	.00	. 01	.18	778	, 83	.79	1,09	. 93	1.14	.39	, 02	6,16	8, 44
-maner, Calmenton on the	12	.00	.00	.0	. 10	. 56	. 82	. 94	. 67	. 66	.86	,30	,08	4.99	5,58

# REPORT OF THE CHIEF SIGNAL OFFICER.

# Total showing monthly rainfall averages, &c.—Continued.

Name and State.	Years of record.	July.	August,	September.	October.	November.	December.	January.	February.	March.	April.	May.	June,	Average for sea- son,	Total for sea- sons 1885-'86,
Caliente, Cal.  Keene, Cal.  Keene, Cal.  Tehachapi, Cal.  Fort Tejon, Cal.  Mojave, Cal.  Mojave, Cal.  Camp Cady, Cal.  Point Conception, Cal.  Sant Barbara, Cal.  Sant Barbara, Cal.  San Buenaventura, Cal.  Nordhoff, Cal.  Ravenna, Cal.  Newhall, Cal.  San Fernando, Cal.  Cahnenga Valley, Cal.  Los Angeles, Cal.  Spadra, Cal.  Anaheim, Cal.  Santa Monica, Cal.  Drum Barracks, Cal.  Colton, Cal.  San Bernardino, Cal.  Riverside, Cal.  Riverside, Cal.  Hadio, Cal.  Fort Yuma, Cal.  Yuma, Ariz.  Poway, Cal.  Fall Brook, Cal.  Carson City, Nev.  Tucson, Ariz.  Fort McDermitt, Nev.  La Grange, Cal.  Bird's Landing, Cal.  Golozales, Cal.  Middletown, Cal.  Middletown, Cal.  Middletown, Cal.  Modary, Cal.  Middletown, Cal.  Middletown, Cal.	111 9 100 5 8 2 2 8 8 18 11 5 7 7 10 9 9 4 9 9 12 12 9 9 3 3 5 5 16 6 6 9 9 9 16 11 1 8 15 10 7 7 11 18 19 19 19 19 19 19 19 19 19 19 19 19 19	.02 .08 .35 .00 .01 .00 .00	.01 .63 .00 .00 .00 .00 .00 .00 .00 .00 .00 .0	.03 .00 .01 .01 .00 .00 .05 .03 .01 .01 .00 .00 .00 .00 .00 .05 .02 .00 .00 .05 .02 .00 .05 .05 .01 .00 .00 .05 .00 .00 .00 .00 .00 .00 .00	. 68 . 37 1, 00 . 33 . 30 . 45 . 44 . 36 . 32 . 32 . 36 . 42 . 36 . 42 . 36 . 42 . 36 . 12 . 03 . 24 . 43 . 45 . 60 . 61 . 63 . 64 . 64 . 64 . 64 . 64 . 64 . 64 . 64	, 82 , 85 , 66 , 66 , 27 , 44 , 1, 05 , 4 , 1, 19 , 1, 19 , 1, 14 , 1, 19 , 1, 14 , 1, 19 , 1, 10 , 1, 10 , 1, 10 , 10 , 10 , 10	1.67 2.09 1.67 4.32 1.129 1.187 3.81 2.53 2.24 2.25 1.178 2.26 1.152 2.24 3.10 1.36 3.10 1.36 3.10 1.36 3.10 1.36 3.10 1.36 3.10 1.36 3.10 1.36 3.10 1.36 3.10 1.36 3.10 1.36 3.10 3.10 3.10 3.10 3.10 3.10 3.10 3.10	1. 36 1. 72 1. 47 1. 62 1. 80 1. 18 4. 03 3. 86 6. 18 3. 30 2. 25 4. 33 3. 30 3. 15 1. 73 3. 30 3. 15 1. 73 3. 30 3. 30 3. 15 1. 17 3. 30 3. 30 3. 30 3. 15 1. 17 3. 30 3. 30 30 30 30 30 30 30 30 30 30 30 30 30 3	1.917.2.57.3.1.32.2.57.3.1.32.2.57.3.1.32.2.57.3.1.32.2.57.3.1.32.2.57.3.3.3.2.3.3.3.3.1.97.3.3.3.3.3.3.3.3.3.3.3.3.3.3.3.3.3.3.	.56 .377 2.73 2.09 2.37 5.32 2.49 2.61 3.60 2.95 1.92 1.92 1.92 1.97 1.97 1.93 .14 .21 .22 .22 .21 .50	2, 20 1, 79 3, 49 40, 25 1, 48 1, 48 1, 48 1, 48 1, 18 2, 18 2, 18 2, 18 2, 18 2, 18 2, 18 1, 12 1, 13 2, 18 1, 13 2, 18 1, 13 2, 18 1, 13 2, 18 1, 13 2, 18 1, 13 2, 18 1, 19 1, 19	.02 .08 .11 .35 .38 .38 .1. 24 .09 .43 .97 .45 .47 .07 .63 .44 .43 .02 .00 .05 .63 .44 .43 .02 .00 .00 .00 .00 .00 .00 .00 .00 .00	. 12 . 22 . 24 . 21 (*) . 00 . 16 . 14 . 27 . 47 . 27 . 47 . 20 . 20 . 20 . 10 . 06 . 10 . 00 . 00 . 00 . 00 . 00 . 00 . 00	10, 98 13, 28 11, 04 4, 92 3, 09 9, 85 4, 92 3, 09 11, 77 77, 71 11, 70 77, 71 14, 80 16, 13 8, 74 9, 85 11, 06 9, 85 11, 06 11, 10 11,	12, 31 15, 22 7, 62 24, 23 24, 23 21, 12 30, 44 18, 25 22, 55 22, 55 22, 55 22, 55 24, 65 26, 66 27, 70 27, 70 28,

*Trace.

## APPENDIX 7.

## REPORT UPON THE SYSTEM OF COTTON-REGION OBSERVATIONS.

SIGNAL OFFICE, WAR DEPARTMENT, Washington City, June 30, 1886.

SIR: I have the honor to submit my annual report of the work done in connection

with the system of cotton-region reports for the year ending June 30, 1886.

The system continued in active operation from July 1 to October 31, after which observations were discontinued for the year. The appropriation being insufficient to carry on the observations and reports during the period contemplated and desired by cotton interests, the resumption of the service in the spring was delayed until April 10. The information is given the widest publicity throughout the cotton-growing States by being bulletined daily at prominent points and published in the newspapers; the editors allowing ample space for the purpose. Copies are also sent to the cotton exchanges, boards of trade, &c. The producer, the shipper, and others interested in the growing crop have, in their correspondence with this office, uniformly testified to the great benefits derived from the careful study of the reports, which contain the mean maximum and mean minimum temperatures and the rainfall at over one hundred and fifty places in the cotton districts.

This branch of the service has, since its inception, labored under many disadvantages, resulting from insufficiency of money for its proper maintenance, which rendered it impossible to establish the necessary number of points of observation over the wide area of country which it was the desire of this office to benefit by the reports; and also the fact that no money being appropriated by Congress for telegraphing the observations, the generosity of the various railroad companies and telegraph lines had to be depended upon for the free transmission of the messages, which proved a very unsatisfactory arangement.

The pay of the special observers employed, being but 20 cents per day, offers small inducement to take and forward reports with that care and promptness which they should receive in order to make them thoroughly reliable and of the greatest value to all

The transmission of the observations over the telegraph lines under the circumstances just stated can be easily slighted, and this office has no alternative but to accept any explanation that may be given. The difficulties named can be readily obviated if the estimates submitted to Congress are favorably acted upon. Provision has been made in these for 1886–787 for a total of 250 stations; for the increase of pay of the special observers to 50 cents per report, and the payment by the Government of the necessary telegraph to the graph the graph the graph the graph the graph to the section be desired.

servers to 50 cents per report, and the payment by the Government of the necessary telegraph tolls from the special stations to the section headquarters.

Before the cotton season opened in April last it was decided that observers in charge of the section centers should visit and inspect each of the special stations; and this has since been done, and much good in the way of better service, greater accuracy and promptness in rendering reports has resulted. Many of these stations had never before been visited by a representative of the Signal Service. Each inspector was charged to investigate and correct all the irregularities; to properly instruct the observers; to inspect the condition of the Government property on hand, and recommend such action as seemed necessary.

The following cotton-region stations were inspected by the observer in charge of the section center:

Sergeant S. W. Beall, Atlanta, Ga., visited Gainesville and Toccoa, Ga.; Anderson, Greenville, and Spartanburg, S. C.; Griffin, Newnan, West Point, and Cartersville, Ga. Sergeant David Fisher, Augusta, Ga., visited Batesburg, Columbia, Chester, and Greenwood, S. C.; Blackville, S. C.; Waynesborough, Ga.; Allendale, S. C.; Camack, Washington, Union Point, and Athens, Ga.

Sergeant J. II. Smith, Charleston, S. C., visited Saint George's, Branchville, Saint

Matthew's, Jacksonborough, Yemassee, Hardeeville, and Kingstree, S. C.

Sergeant E. O'C. MacInerney, Galveston, Tex., visited Houston, Columbia, Cuero, Weimar, Luling, Austin, Brenham, Hearne, Waco, Belton, Corsicana, Dallas, Weatherford,

Tyler, Longview, Huntsville, Sour Lake, and Orange, Tex.
Sergeant B. L. Goulding, Little Rock, Ark., visited Devall's Bluff, Brinkley, Kensett, Newport, Madison, Helena, Arkansas City, Monticello, Pine Bluff, Magnolia, and Tex-

arkana, Ark.; Paris, Tex.; Prescott, Malvern, and Russellville, Ark.

Sergeant D. T. Flannery, Memphis, Tenn., visited Grand Junction, Tenn.; Corinth, Miss.; Tuscumbia, Decatur, and Scottsborough, Ala.; Holly Springs, Oxford, Grenada, Batesville, and Hernando, Miss.; Covington, Dyersburg, Milan, Paris, Bolivar, Brownsville, and Arlington, Tenn.
Sergeant Appleton Pritchard, Mobile, Ala., visited Waynesborough, and Meridian,

Miss.; Livingston, Ala.; Macon, Columbus, Aberdeen, and Okolona, Miss.

Sergeant Lawrence Dunne, Montgomery, Ala., visited Fort Deposit, Greenville, Evergreen, Selma, Pine Apple, Marion, Calera, Birmingham, Opelika, Ala.; Columbus, Ga.; and Eufaula, Ala.

Sergeant Meyer Herman, New Orleans, La., visited Amite City, La.; Brookhaven, Hazelhurst, Port Gibson, and Natchez, Miss.; Alexandria, Natchitoches, Coushatta Chute, Minden, Cheneyville, Opelousas, and Lafayette, La.

Sergeant S. C. Emery, Savannah, Ga., visited Jessup, Eastman, Macon, Smithville, Fort Gaines, Albany, Thomasville, Bainbridge, and Quitman, Ga.; Live Oak, Waldo, and Fernandina, Fla.; Way Cross, Allapaha, and Millen, Ga.
Sergeant J. W. Byram, Vicksburg, Miss., visited Edwards, Jackson, Lake, Miss., and

Monroe, La.

Private A. J. Mitchell, stationed at Smithville, N. C., was detached and visited Goldsborough, New-Berne, Weldon, Raleigh, Salisbury, and Wadesborough, N. C.; Cheraw and Florence, S. C.; and Lumberton, N. C.

Full and complete instructions for the guidance of cotton-region observers were prepared in pamphlet form, and copies were furnished by the inspectors to each special ob-

server in charge of a special cotton-region station.

These instructions are in such complete form that in the event of any change being necessary, the newly-appointed observer could easily familiarize himself with the requirements of the position.

The result of these inspections was very satisfactory; and all instruments are now properly exposed, and the instrument shelters located in the best positions obtainable.

Heretofore the instrument shelters at nearly all stations have been located on or near the depot or freight building; but as the constant jarring caused by passing trains had a tendency to lower the index point of the minimum thermometers the inspectors were instructed to remove all shelters liable to be thus affected, and have them set up in more advantageous positions. The rain-gauges at all the special stations have also been examined, and where the exposure was considered defective better localities have been secured.

The special cotton-region observers have been personally instructed in their duties, and, as far as the money appropriated for its support will permit, the cotton-region serv-

ice is now in the most effective condition possible.

There are now in operation twelve centers for collecting the reports, eight regular Signal Service stations taking cotton-region observations, and one hundred and thirty-five special cotton-region stations, making one hundred and fifty-five places in all at which these observations are made and reported.

The following stations were established during the year:

Brenham, Tex. (Galveston, Tex., center); Nebo and Forrest City, Ark. (Little Rock, Ark., center); and the following stations were discontinued: Beaumont, Tex. (Galveston, Tex., center); Madison and Nebo, Ark. (Little Rock, Ark., center); Dalton, Ga. (Atlanta, Ga., center).

The observer at Chattanooga, Tenn., takes cotton-region observations, and telegraphs

them, daily, to Atlanta, Ga.

The name of the station at Withe, Tenn., was changed by the Post-Office Department

to Arlington.

Each district sends by mail, daily, to observer, New Orleans, La., a copy of Form 1386, containing the maximum and minimum temperatures and the rainfall at each special station in the district.

To obviate any difficulty that might arise on account of the telegraph lines being down or in trouble, and thus delay the transmission of reports to the centers, each cottonregion observer mails, daily, to his section center a copy of the cipher report (Form 203); and as soon as the missing report is received at the section center, the information it contains is entered on a Form 138b (cotton-region bulletin), and mailed to New Orleans.

I would urgently recommend that the following be submitted in the next year's estimates for the appropriations for this service, under the item headed "Observations and expenses incidental thereto, announcing the probable approach and severity of frosts, for the benefit of the cotton region of the United States; Cotton-region observations and reports:" Two hundred and fifty stations at 50 cents per day, from April 1 to October 31, \$26,750; instruments and instrument shelters, \$2,000; incidentals, \$1,250. And under the item headed "Telegraphing reports, messages, and other information in connection with the observation and report of storms, &c.:" For collecting cotton-region reports, \$10,700.

These reports have, heretofore, been telegraphed by the railroad companies free of charge, but owing to many delays, failures, and other irregularities resulting from the free system, it is now desired to secure for their transmission that promptness and regu-

larity which can only be obtained by regular rates.

The following copy of a letter from Mr. James F. Nanry, secretary committee of information and statistics, New York Cotton Exchange, New York City, is added to this report for the reason that it furnishes valuable information in regard to the cotton crop, and gives the opinion of business men upon the usefulness of the reports made at the stations in the cotton region:

"NEW YORK COTTON EXCHANGE "New York, May 17, 1886.

"DEAR SIR: Pressure of private and other business has hindered our committee from looking out the towns which we recommend to be used as points from which to get daily reports of the weather, especially as affecting the cotton crop

"The most important thing for the crop is the rainfall, and it should be reported every twenty-four hours with accuracy, not in averages from centers, but the actual amount at

each place.

"If to this is added the maximum and minimum thermometer readings for the twentyfour hours, there is nothing more to be desired, and any planter, factor, or dealer who

will study these three records can get a good idea of the crop prospects.

'In choosing the towns, we have tried to keep as closely as possible to your published list of stations dated March 1, 1884, General Orders No. 21. Some places where little or no cotton is grown we have dropped, others we have added when much cotton is We have also kept to the railroad lines as much as possible, though that plan rather ties down the distribution of places.

"We hope you will be able to put this plan into operation, as by it alone can we get

accurate and reliable weather reports to judge of the cotton crop.

(Here follows a list of stations.) "Very respectfully, yours,

"JAMES F. NANRY. "Secretary Committee of Information and Statistics.

"Brig. and Bvt. Maj. Gen. W. B. HAZEN, , "Chief Signal Officer, U.S. Army, Washington, D. C."

I am, very respectfully, your obedient servant,

F. B. DAY.

Second Lieutenant, Signal Corps, U. S. Army.

The CHIEF SIGNAL OFFICER OF THE ARMY, Washington, D. C.

#### APPENDIX 8.

#### REPORT ON THE DISPLAY OF SIGNALS FOR THE PROTECTION OF MARINE INTERESTS.

SIGNAL OFFICE, WAR DEPARTMENT, Washington City, June 30, 1896.

SIR: I have the honor to make the following report upon the system of cautionary wind signals used by the Signal Service for the protection of marine interests, in operation during the year ending this day:

The display of signals has continued during the past year as heretofore.

On December 1, 1885, signals, with the exceptions noted below, were discontinued at all stations on Lake Superior, and at all other lake ports on December 15, 1885, navi-

gation having closed for the season.

The tisplay of cautionary signals continued throughout the entire year at the following places: Grand Haven and Ludington, Mich.; Milwaukee, Wis.; Saint Joseph, South Haven, and Manistee, Mich. The display was resumed on Lake Superior May 1, 1886, and at all other points of display on the lakes April 15, 1886, on the resumption of navigation.

The new signals recently adopted by this service for announcing the approach of wind storms are of three kinds, viz.:

The cautionary signal.
 The direction signal.

3) The on-shore signal.

The cautionary day signal is a square red flag, with black square center; the night signal is a red light. When hoisted it indicates that a wind velocity of 35 miles per hour, or over, is expected to blow within 100 miles of the places at which the signals

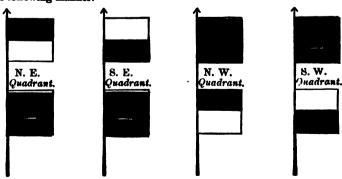
are displayed. This velocity of wind is considered dangerous to all classes of shipping. The direction signal is a square flag, composed of two horizontal stripes, one black and the other white. It is only displayed with the cautionary signal flag, and indicates from what quadrant the dangerous wind is expected to come. For the purpose of designating these quadrants the compass has been divided into the NE., SE., SW., and NW. quadrants. In the order to hoist a direction signal it is stated from which quadrant the dangerous wind is first expected. There is no night display for the direction signal.

The on-shore day signal is a square flag composed of four smaller squares, two white and two black, so arranged that squares of like colors touch each other at the inner corners. It is only displayed at lake ports where regular full-reporting meteorological stations of the service are in operation.

The on-shore signal indicates that the wind will blow in an on-shore direc-

tion with a velocity of from 20 to 35 miles per hour at the place where the signal is displayed. This velocity of wind is considered dangerous to small vessels, barges, and tows on the lakes. The on-shore night signal is a white light.

A direction signal is not hoisted in connection with the on-shore signal. is only displayed with the cautionary signal, and not more than 3 feet above or below it, in the following manner:



It will be seen from the above cut that the direction flag is above the cautionary flag for easterly winds and below for westerly, while the black stripe in the direction flag is above the white stripe for northerly winds and below for southerly.

When the cautionary signal is hoisted alone, it indicates that the direction from which

the dangerous wind may come has not been determined.

This new system of cautionary signals went into operation May 1, 1886. It is not necessary to advert to the old system of cautionary signals, as they have been fully

explained in previous reports.

The velocity of wind heretofore accepted as justifying a cautionary signal has been 25 miles per hour at all stations, as shown by the reading of the anemometer at the place where the display was made. The velocity to justify a signal has been changed, and cautionary signals are not now ordered unless a wind velocity of 35 miles or more per hour is expected, as has already been explained.

The observer at each cautionary station using an anemometer has been informed the number of miles per hour, as shown by his anemometer, that will be equal to the above-mentioned verifying velocity.

The special display station at Traverse City, Mich., was discontinued March 16, 1886. The following special display stations have been established during the year: Barnegat City, N. J.; Cedar Tree Neck, Mass.; Chicago Water Crib, Ill.; Point Judith, R. I.; Sankaty Head Light, Mass.

The display of wind signals has been suspended at Southeast Light, R. I., pending re-

pairs to the cable, which is broken.

The special display stations were inspected by the observers in charge of section centers during the last half of the year. This inspection was imperatively necessary on account of the adoption of the new system of wind and direction signals, and from the experience of former years I am of opinion that these stations should be visited by the observers from the section centers at least once each year to see that the work is performed in a satisfactory manner and that shipping interests are fully served. Each inspector was charged to properly instruct the displaymen in the manner of hoisting and lowering the signals, and in their general duties; to inspect the Government property, and recommend such action as seemed necessary to make the station and display of the greatest benefit to the public.

The following display stations were thus inspected:

Sergt. Allen Buell, Chicago, Ill., visited Saint Joseph, South Haven, Muskegon, Montague, Pentwater, Ludington, Manistee, Frankfort, Northport, Elk Rapids, Charlevoix,

Petoskey, and Cheboygan, Mich.

Sergt. S. W. Rhode, Milwaukee, Wis., visited Racine, Kenosha, Sheboygan, Manitowoc, Kewaunee, Ahnapee, Sturgeon Bay, and Green Bay, Wis., and Menominee, Mich. Sergt. N. B. Conger, Detroit, Mich., visited Sand Beach, Bay City, and East Tawas, Mich.

Sergt. Peter Wood, Erie, Pa., visited Ashtabula, Ohio, and Dunkirk, N. Y. Sergt. J. G. Linsley, Oswego, N.Y., visited North Fair Haven and Cape Vincent, N.Y. Private B. A. Kinney, Portland, Me., visited Bath, Rockland, Southwest Harbor, and Boothbay, Me.

Sergt. O. B. Cole, Boston, Mass., visited Marblehead, Gloucester, and Newport, Mass.; Portsmouth, N. H.; New Bedford, Wood's Holl, Hyannis, Highland Light, Bass River

Light, and Provincetown, Mass.

Sergt. John G. Lynch, New London, Conn., visited Stonington, Conn.; Bristol, R. I., Fall River, Mass., and Newport, R. I.

Sergt. J. O. Conway, Narragansett Pier, R. I., visited Point Judith, R. I.
Sergt. Meyer Herman, New Orleans, La., visited Port Eads, La.
Sergt. J. P. Sherry, Norfolk, Va., visited Fort Monroe, Va.
Sergt. S. C. Emery, Savannah, Ga., visited Port Royal, S. C.; Tybee Island, and

Brunswick, Ga.
Sergt. J. W. Smith, Jacksonville, Fla., visited Fernandina, Fort George Island, and Saint Augustine, Fla.

Sergt. E. W. McGann, Rochester, N. Y., visited Charlotte, N. Y. Sergt. W. W. Eichelberger, New York City, visited City Island, N. Y. Sergt. I. A. Reed, Indianola, Tex., visited Corpus Christi, Tex. Sergt. Appleton Pritchard, Mobile, Ala., visited Fort Morgan, Ala.

Sergt. J. H. Sherman, New Haven, Conn., visited New Haven Light, Conn.

Private II. B. Boyer, Key West, Fla., visited Sand Key Light, Fla.

Full and complete instructions for the guidance of displaymen have been prepared in pamphlet form, and copies will shortly be furnished each special display station.

I would earnestly recommend that the following be included in the next estimate of appropriations for this service, under the item headed: "Expenses of storm, cautionary, and other signals on the sea, lake, and gulf coast of the United States, announcing the

probable approach and force of storms, including the pay of observers, services of operators, lanterns, flags, &c.:"

Pay of displaymen	5,000 00
	15, 000 00

The flag-staff at the special display stations of the Service are located as below:

Ahnapee, Wis.—The flag-staff is on a slight eminence inside the harbor piers and about 40 feet high; the signal can be seen from the lake and harbor.

Bass River Light, Mass.—The flag-staff is near the light-house.

Bath, Me.—The flag-staff is on the roof of the United States custom-house, which commands a view of the whole city and harbor.

Barnegat City, N. J.—The flag-staff is located in front of the Oceanic Hotel, and commands a fine view of the ocean.

Bay City, Mich.—The flag-staff is at the foot of Seventh street, and can be seen for 3 miles in any direction; it is about 75 feet high.

Boothbay, Mc.—The flag-staff is situated on a hill at the head of the bay, commanding a good sight of the harbor and its entrance.

Brunswick, Ga.—The flag-staff is on the top of a high building, and commands a fine

Cheboygan, Mich.—The flag-staff is on top of the village hall, and can be seen from the

City Island, N. Y.—The flag-staff is on the roof of the office of the Ship News As-

sociation, which is also the office of the displayman. Corpus Christi, Tex.—The flag-staff is on the top of a high hill. The flags and lights can be seen for about 3 or 4 miles.

Dunkirk, N. Y.—The flag-staff is on the top of a five-story building, commanding ing a good view of the harbor.

East Tawas, Mich.—The flag-staff is on the beach near the steamboat landing, and is 100 feet high. It can be seen distinctly all over Tawas Bay.

Frankfort, Mich.—The flag-staff is on Main street, in the western part of the village. A new pole will probably be erected in front of the post-office on Main street, where the signals can be seen from every part of the harbor.

Gloucester, Mass.—The flag-staff is on the top of the custom-house, and the signals are

visible from all parts of the harbor.

Green Bay, Wis.—The flag-staff is on the top of a grain elevator, and can be seen from the bay and river.

Highland Light, Mass.—The flag-staff is close to the station house, and near the lighthouse. All vessels going in and out of the bay pass within view of the signal.

Hyannis, Mass.—The flag-staff is on a high bank near the light-house.

Kenosha, Wis.—The flag-staff is on the top of the Simmons Building, and can be seen

from every portion of the harbor and bay.

Kewaunce, Wis.—The flag-staff is on a high hill overlooking the town and harbor. The location is excellent, and the signals can be seen by vessels passing far out on the

Ludington, Mich.—The flag-staff is at the corner of Ludington avenue and Harrison street. The pole is 150 feet high, and the location is excellent.

Munistee, Mich.—The flag-staff is on the roof of the Englemann block, corner of South Water and Maple streets. The location is very good, and the flag can be seen from every part of the harbor.

Manitowoc, Wis.—The flag-staff is on top of the telegraph-office building, one block

from the river, and can be seen from every part of the river and harbor.

Marblehead, Mass.—The flag-staff is in front of the town hall, which is only one block from the beach. The signals are plainly visible from the river and harbor and for a distance of from 10 to 12 miles out on the bay.

Fort Morgan, Ala.—The flag-staff is on the parapet of Fort Morgan.

Montague, Mich.—The flag-staff is on the roof of a warehouse, between Montague and Whitehall. It can be seen from every part of the harbor.

Muskegon, Mich.—The flag-staff is on the roof of the Mason block, corner of Western avenue and First street, in the central part of the city. The display can be seen from every part of the harbor.

New Bedford, Mass.—The flag-staff is on the wharf of the Philadelphia and Reading Coal Company, and is visible from all parts of the harbor.

New Haven Light, Conn.—The flag-staff is on the top of the abandoned light-house at this station.

Pentwater, Mich.—The flag-staff is in a central part of the town. It can be seen from every part of the village.

Petockey, Mich.—The flag-staff is on Lake street, between the depot and the Cushman

House. It can be seen from every part of the harbor.

Provincetown, Mass.—The flag-staff is on the top of a high hill in the center of the town.

Racine, Wis.—The flag-staff is on the roof of the warehouse of the Goodrich Transportation Company at harbor entrance. Vessels passing in or out of port pass within 50 feet of the flag-staff.

Rockland, Me. - The flag-staff is on the roof of the United States custom-house.

Saint Joseph, Mich.—The new flag-staff to be erected will be placed on a high bluff overlooking the harbor, at the foot of Ship street, and can be seen from every part of the harbor.

Sand Beach, Mich.—The flag-staff is immediately in front of the displayman's office, and can be seen from the lake and bay.

Sheboygan, Wis. - A new flag-staff will shortly be erected at this station.

South Haven, Mich.—The flag-staff is on a high bluff in the western part of the town, and can be seen from every part of the harbor.

Southwest Harbor, Me.—The flag-staff is on a hill overlooking the harbor, and in an excellent position.

Stargeon Bay, Wis.—The flag-staff is on the dome of the Court House, and has an elevation of about 150 feet above ground. The signals can be seen from Lake Michigan, and from the canal and Sturgeon Bay to the entrance from Green Bay.

Tybee Island, Ga.—The flag-staff is on the top of the old tower, the highest point on

the island, and is 40 feet above the ground.

Wood's Holl, Mass.—The flag-staff is at Nobska Point near the light-house. The displayman at Wood's Holl displays the signals from a staff in front of his house, and they are duplicated at Nobska Point. The signals can be seen by all vessels passing through Vineyard Sound.

Very respectfully, your obedient servant,

F. R. DAY, Second Lieutenant, Signal Corps.

The CHIRF SIGNAL OFFICER OF THE ARMY.

Washington, D. C.

## APPENDIX q.

#### RIVER REPORTS AND FLOOD-WARNINGS.

SIGNAL OFFICE, WAR DEPARTMENT, Washington City, June 30, 1886.

SIR: I have the honor to submit my report on the system of river and flood reports for the year ending this day, together with such additional data as have been gathered since

last report.

The value of simultaneous river reports from and between river stations, at selected points in the various water-sheds of the country, does not consist wholly in the forewarning of dangerous rises, however valuable these warnings may be. It is important that in addition, continuous and exact observations should be made and permanent records kept for the benefit of the commerce of our navigable rivers and shipping interests generally. It is very important to know the stage of water at all times, but more especially is this valuable when the water is at a very low stage, as, from the information furnished by the records at the Signal Service river stations, captains and others can determine the height of water at places where there are dangerous bars.

Since the establishment of the Pittsburg, Chattanooga, and Saint Louis River systems, with the observer at the central station in charge of the special reporting stations in the section, the plan has met with such gratifying results that it has been widely extended, and centers have been established at Cairo, Leavenworth, Little Rock, La Crosse, Nashville, New Orleans, Shreveport, and Vicksburg, for the collection of river reports from the special stations, for distribution to places and interests affected by high and low water.

It being advisable to have the gauges at a number of the river stations rebuilt or replaced, the bench-marks and zeros properly determined, the reports distributed over as large an area as possible, and the service made of as much benefit to the public as the money allotted for the purpose would permit, Mr. H. W. Brewer, civil engineer and river expert, has during the past two years inspected the following river stations, and, when possible, determined the height above sea-level of the zero of the gauges and the danger lines, together with such other information as would tend to give these river reports to the public in the shortest time, and at places where they would be of the most benefit. The following places have been thus visited by Mr. Brewer:

Decatur, Ala., Johnsonville, Tenn., Paducah, Ky., Warsaw, Ill., Evansville, Ind., Louisville, Ky., Cincinnati, Ohio, Marietta, Ohio, Wheeling, W. Va., Camden, Ark., Bayou Sara, La., Vicksburg, Miss., Yazoo City, Miss., Arkansas City, Ark., Little Rock, Ark., Newport, Ark., Fulton, Ark., Shreveport, La., Monroe, La., Girard, La., Delhi, La., Coushatta Chute, La., Alexandria, La., New Orleans, La., Nashville, Tenn., Carthage, Tenn., Burnside, Ky., Saint Louis, Mo., Saltsburg, Pa., Mahoning, Pa., Brookville, Pa., Weston, Pa., Parker's Landing, Pa., Clarion, Pa., Warren, Pa., Freeport, Pa., Johnstown, Pa., Oil City, Pa., Lock No. 4, Pa., Morgantown, W. Va., and Rowlesburg, W. Va.

As an example of this work, the observer at Cairo, Ill., sends at 3 p. m, daily, two special messages, one to the river observer at Evansville, Ind., containing the river words from Pittsburg, Cincinnati, Louisville, Mount Carmel, Nashville, Chattanocza, Paducah, and Saint Louis; and the other to Messrs. Fowler, Crumbaugh & Co., at Paducah, Ky., containing the river readings at Cairo, Chattanocga, Cincinnati, Evansville, Louisville, Mount Carmel, Nashville, Pittsburg, and Saint Louis.

These telegrams, which are sent in cipher, are, upon being received, translated and entered on manifold bulleting and poetal in prominent places poetal and provided in prominent places poetal and provided in prominent places.

tered on manifold bulletins and posted in prominent places near the steamboat landings. At the urgent request of the citizens of Shawneetown, Ill., and vicinity, for reports of the stage of water in the Wabash and Ohio Rivers during floods and dangerous rises, a special river station was established on the Wabash River at Vincennes, Ind., March 1 1886. A contract has been made for the erection of a river-gauge at Vincennes, and regular observations will be taken during floods and telegraphed to Shawneetown, Ill., where arrangements have been made for bulletining them for the information of the public.

The observer at Cairo, Ill., has been instructed to send special reports by telegraph to Shawneetown when the water at Cincinnati marks 38 feet, and is rising. reports will contain the river heights at Cincinnati, Louisville, Evansville, and Mount Carmel; and they will be suspended when the Ohio River begins to fall at Evansville, as it is then considered that the danger at Shawneetown is passed.

The appropriation for river and flood reports not being sufficient to continue both the 7 a. m. and 2 p. m. river observations at the stations in the Pittsburg, Pa., section, it was necessary, on March 1, 1886, to discontinue the 2 p. m. river observation at all places

in that section that had, prior to that date, taken two observations daily

The time of taking the gauge readings at Burnside, Ky., was changed by Instructions No. 66, 1885, so that observations will be taken hereafter from December 1 to August

1, each year; and at Carthage, Tenn., from December 1 to July 1.

The following stations have not been inspected by Mr. Brewer: Albany, Oreg.; Colusa, Cal.; Charleston, Tenn.; Clinton, Tenn.; Dardanelle, Ark.; Eugene City, Oreg.; Folsom City, Cal.; Grand Tower, Ill.; Harper's Ferry, W. Va.; Kingston, Tenn.; Leadvale, Tenn.; Lexington, Mo.; Loudon, Tenn.; Marysville, Cal.; Mount Carmel, Ill.; Mount Holly, N. C.; Oroville, Cal.; Peoria, Ill.; Rockwood, Tenn.; Strawberry Plains, Tenn.; Saint Joseph, Mo.; Umatilla, Oreg., and Vincennes, Ind.

At the present date there are sixty-eight paid special river stations in operation. The river observer at Muscatine, Iowa, makes no charge for rendering monthly re-

ports to this office.

The following river stations were established during the year: Lock No. 4, Pa. (Pittsburg, Pa., center), December 11, 1885; Dardanelle, Ark. (Little Rock, Ark., center), January 11, 1886; Lexington, Mo., (Saint Louis, Mo., center), February 18, 1886; Vincennes, Ind. (Cairo, Ill., center), March 1, 1886.

The following river stations were discontinued during the year: Prescott, Wis. (La Crosse, Wis., center), July 24, 1885; Brownsville, Pa. (Pittsburg, Pa., center), December 1, 1885; Brunswick, Mo. (Saint Louis, Mo., center), December 15, 1885; Rockwood, Tenn. (Chattanooga, Tenn., center), December 31, 1885.

The following extracts from letters written by observers at river stations, and from special river observers, give interesting data concerning the floods that occurred during

the year, and the benefits that have been derived from river reports:

Mr. J. B. Miles, special river observer at Helena, Ark., in a letter dated May 3,

"You will notice in my report that the river rose rapidly on April 25 and 26, 1886, and suddenly fell off. This rapid rise continued until during the night of April 26. when those who were watching the levees and gauge said it not only stopped rising, but fell suddenly when the levees gave way. At the time the levees gave way the river was rising half an inch an hour and remained stationary for a few hours, and then commenced rising nearly one-fourth of an inch per hour, until at sundown of the 27th when the levees gave way at Austin, and then the river fell about one inch, but afterwards regained the fall and continued to rise until it attained the highest point ever reached here-48.1 feet."

The observer at Keokuk, Iowa, in a letter dated June 3, 1886, says:

"The river reports are of importance to steamboatmen, raftsmen, and lumbermen, at all seasons of the year, and the masters and pilots of all boats stopping consult the bulletin for reliable information.

"Steamboatmen then know how deep they may load their boats, and what channels

may be safely run.

"Raftsmen can ascertain if it is safe to run the rapids, saving the time of coming

through the Des Moines Rapids Canal.

"On May 4, 1886, Mr. B. B. Hinman, a capitalist owning a large tract of bottom lands south of the Des Moines River, called at the office for information. gave as his opinion, based on the reports received, that there was danger of an additional rise of two feet. Mr. Hinman at once put a force of men to strengthening his levees; and neighboring farmers took the same precaution, saving their lands from overflow. Had these lands been overflowed the planting of the crops would have been greatly retarded."

The observer at New Orleans, La., in a letter dated June 8, 1886, says:

"The system of special river stations and reports in this section is of great benefit to rivermen and shippers, as is shown by the following: The greater portion of the Ouachita River was too low for navigation, so that Capt. L. V. Cooley was compelled to store freight for several trips, to points that could not be reached on the banks of the river below these points until he had navigable water. He asked me once if he could make a trip next day and receive freight for all his points. I advised him to do so, as heavy rains were falling in that section, as shown by the reports. He acted on the advice. In the mean time the river rose about 10 feet. He was therefore able to deliver the freight he had aboard, and that which he had stored."

"This is one of many instances where these reports have been of such great value and benefit to the rivermen and shippers. The amount saved by these reports in this section alone will more than pay for the entire river service."

The observer at Cairo, Ill., in a letter dated June 10, 1886, says:

"The special telegram from your office, dated March 30, 1886, announcing the overflow of the low lands in this vicinity, was of incalculable benefit to both farmers and railroad companies, as well as all classes of business situated along the river front. Farmers immediately took steps to move their stock to a place of safety, and to dispose of their grain. Railroad companies began to rip-rap their road-beds, and all classes of business on the river front made preparations for the rise predicted. The value of the river reports to merchants, railroad companies, factories, mills, and farmers in this vicinity cannot be estimated. Every available means was utilized in warning the people of the coming flood. All railroad companies and business men were furnished with a copy of the a.m. and p.m. river bulletin. The railroad companies had the full report telegraphed to their presidents, stationed in other cities, daily, and every railroad station along the river was furnished with the full report in the same way."

The observer at Augusta, Ga., in a letter dated June 12, 1886, commenting on the

necessity of river stations, says:

"Were it possible to establish a special river station at a point below the junction of the Broad and Savannah Rivers, a distance by water of 100 miles from here, and daily reports furnished this station, the knowledge of sudden rises in the river would prove of great value to the farmers along the river country, by means of which they would be enabled to shelter stock in places of safety and secure them beyond reach of these devastating and destructive floods."

The observer at Louisville, Ky., in a letter dated June 9, 1886, says:

"That the system of river reports is beneficial to those who have interests at stake on the river and adjacent to it, is shown by the interest, these people take in them. During the recent flood they were especially valuable, and were watched by rivermen and others whose interests were threatened by a sudden rise.

"The Signal Service reports are the only ones regarded as authentic, and frequent requests for information are made to this office by prominent business men of the city, both by telephone and by personal application. The press manifests its interests in the reports by publishing them daily for the benefit of their readers."

The observer at Pittsburg, Pa., in a letter dated June 9, 1886, remarking on the

value of river reports, says:

"There is no other work of the service in this city of which the benefits are so immediately recognized, or more highly appreciated, and the only complaint of those interested in the navigation of the rivers is the few stations in the section, and the few reports from those in operation."

The observer at Nashville, Tenn., in a very comprehensive report, dated June 7, 1886, on the river system in his section and of the floods which occurred between March 31

and April 14, 1886, says:

"Prompt and timely warning was given to the lumber, steamboat, and other interests

in this city, and at Clarksville, Tenn., forty miles below Nashville.
"Tri-daily bulletins were issued from 2 p. m., March 31, to 11 p. m., April 14, 1896. Following the issue of a few special river-bulletins, the entire population seemed to place implicit confidence in the system of river reports, and great was the demand there-Thousands of requests were made as to the probable stage the river would reach. The losses to the business interests were comparatively light, owing to the timely warnings sent out. Families who resided on low ground sustained heavy losses. warned in time, many were unable to remove their household effects to higher ground, simply for the reason that they were too poor to do so.

"The damage to farming lands in the upper counties amounted to considerable. damage would have increased twofold had not timely warning been given. In many

cases the wheat crop became a total loss. Much fencing was also destroyed.

"The following practical illustration may tend to show the great usefulness to which the Cumberland River Service has attained in this community:

"The total expense incurred during the floods, at the special river stations, from March 31, to April 15, 1886, was

"Surnside, Ky.: "Services as special observer "Expense of telegraphing	<b>\$</b> 7	00 00
"Carthage, Tenn.: "Services as special observer" "Cost of telephone messages	10	00 80
"Total cost	\$27	80

"From the above it will be noted that the cost of the special service was only \$27.80. This is an insignificant sum in comparison with the money value of property saved here, and at Clarksville, 40 miles below. As the 'Daily Morning American' wisely puts

"The following table shows the amount of damage, expressed in money value, which occurred in and around Nashville during the floods of March 31, to April 15, 1886, esti-

mated with great care and accuracy:

Name.	Business.	Actual loss.	Estimated loss if warnings had not been given.
Prewitt, Spurr & Co Edfield & Nashville Manufacturing Company.	Lumber, hardwoods, buckets, &c Doors, veneering, and fancy wood- work.	\$550 00 200 00	\$10,000 700
William Sutherland & Co Nashville Cooperage Company B. S. Rhea & Son, grain elevator	Corn, oats, and wheat	350 00 0	4,000 900 500
Indiana Lumber Company Leibmann, Loveman & O'Brien Steamboat interests	Doors, sash, and blinds	350 00 0	800 400 1,100
Nashville Lumber Company	Stables, &c	200 00 300 00 250 00	3,000 2,000 5,000
B.G. Wood Brick-yards. Miscellaneous, household goods,	Bollers and smithing	25 00 5,000 00	9,000 9,000 90,000
street-car obstructions, &c. Total		42,225 00	128, 200

"The two years experience with the river system has already fully demonstrated that it is practicable for the prediction of rises to within one or two feet at this point. only difficulty which has to be overcome is the uncertainty of time it takes for the wave to reach Nashville from the headwaters. This rate of progress varies with certain stages of the water. For instance, if the water is at a low stage at Carthage and Nashville the wave travels slower from Burnside downward; should the water be moderately high, say 15 to 20 feet at Nashville and Carthage, the rate of flow is faster."

The Mobile Cotton Exchange and Chamber of Commerce, in a letter dated November 30, 1885, strongly requested that river stations be established in Upper Alabama and

Northern Mississippi. The following extract is made from this letter:

"The stage of water in the upper rivers of Alabama and Northeast Mississippi is a

question of much importance to the trade relations of Mobile and the interior.

"Several times during the last two months the absence of such information has prevented boats from receiving freight from the upper rivers when their navigation was entirely practicable. There are large quantities of cotton on these rivers now awaiting shipment, and delays and difficulties occur annually for want of this information.

We therefore respectfully request and urge the Signal Service Bureau, in behalf of the merchants of Mobile and the planters and merchants of the interior, that river-

gauges be established."

On account of the insufficient appropriation this office was compelled to inform these gentlemen that it was impossible to establish these stations at present.

Saint Louis, Mo.—The observer at Saint Louis, Mo., in a letter dated June 17, 1886,

says:
"Considerable benefit is derived from the system of special river reports in this sec-

"Telegraphic reports from Hermann and Kansas City, Mo., Warsaw and Peoria, Ill., were received daily, as they are of value to rivermen in this city at all seasons of the

"The New Orleans Anchor Line and the Mississippi Valley Transportation Company receive daily reports by telephone of the stage of the water at the above-named points immediately upon their receipt at this office, and these companies often load their steam-

boats and barges according to the river reports.

"The station at Jerome, Mo., has been of considerable benefit to citizens of that vicinity, who are largely interested in tie-rafting. By means of the rain-gauges they can determine, with some degree of accuracy, the probable height the river will attain, and are thereby enabled to take proper measures for the safety of their rafts."

The following extract of a letter from Mr. W. P. Hammond, a prominent farmer at Warsaw, Ill., furnishes interesting facts in regard to the value of river reports in the vicinity of Warsaw:

"The advantages of the river station at this place to the 80,000 acres of alluvial lands between Warsaw and Quincy is almost inestimable, giving as it does to the owners or occupants timely warning of the approach of dangerous floods from above. The 300,000 acres above the mouth of the Illinois is very much affected by any unusual water at this point, lying as it does just below the Des Moines, which often contributes dangerous additions to the Mississippi floods."

Chattanooga, Tenn.—The observer at Chattanooga, Tenn., in a communication dated June 17, 1836, remarking upon the usefulness of the special river reports in his section,

says:
"Every one was kept fully posted twice a day of the exact stage of the water and amount of rainfall during the recent floods. The most important points above and below, as far as Paducah, were notified by telegraph of the alarming condition of things. trained river observers at Strawberry Plains, Knoxville, and Loudon on the Tennessee, at Clinton and Kingston on the Clinch, at Leadvale on the French Broad, and at Charleston on the Hiawassee Rivers, forwarded their reports promptly and accurately. These reports were the only reliable information received and were the means of saving at least \$500,000 worth of property.

"Without the system of flood reports established by this service the public would be obliged to rely upon such information as the newspapers furnish, and this would be wholly unreliable, owing to the proneness of special correspondents to exaggerate and

send in startling items rather than plain facts.'

#### RIVER STATIONS.

Saint Paul, Minn.—The zero of the river-gauge is 1.75 feet below the low water of September 5 and 13, 1877.

Elevation above sea, 673 feet.

Danger begins at 7 feet.

La Crosse, Wis.—The zero of the gauge is the low water of 1871, and is about 643 feet above sea-level.

The United States engineers give elevation of low water of 1884 as 621.23 feet above sea-level.

Danger begins at 24 feet.

The United States engineers give the highest water as 15.47 feet, occurring in June, 1870.

Wabasha, Minn.—The river-guage is placed on one of the front piles of the elevator wharf near the foot of Alleghany street. It was erected by the United States engineers. The zero is 656 feet above sea-level.

Danger begins at 6 feet, when the low-lands on the Wisconsin side are submerged and some houses at the north end of the town have water on the lower floors.

The highest water known was in 1880, when it reached a height of 13 feet above lowwater mark.

Dubuque, Iowa.—The zero of the river-gauge is the low water of 1864, and is 584 feet above sea-level.

Danger begins at 16 feet.

The United States Engineer's report for 1880-'82 gives the elevation of low water of 1864 as 578.22 feet above sea-level.

Le Claire, Iowa.—The zero of gauge is the low water of 1864, about 545 feet above sea-

Danger begins at 10 feet.

Highest water occurred in June, 1880-14.50 feet.

United States Engineers' report 1880-'82 gives the low water of 1864 as 554 feet above

Davenport, Iowa.—The zero of gauge is 0.34 feet below low water of 1864, and is 545 feet above sea-level.

Danger begins at 15 feet.

Highest water, 20.50 feet, occurred in 1868. The zero of the fiver-gauge on Rock Island bridge is 541.15 feet above sea.

Kcokuk, Iowa.—The river-gauge now in use is one owned by the United States Engineers, and is placed in the canal.

The zero of the gauge is 476.71 feet above sea-level.

Danger begins at 14 feet.

Highest water occurred in 1851—21.50 feet. United States precise bench-mark No. 1 is a copper bolt in coping of shore side of lower lock of the Des Moines Rapids Canal, Keokuk. It is 492.35 feet above sea-level, and 15.64 feet above zero of gauge.

Warsaw. Ill.—The river-gauge is located on the north side of the Keokuk packet

The bench-mark is a cross cut in the top surface of stone sill of a blind window near the north end of the west face of I. W. Barne's brick warehouse, and marked thus: "B. M."

This bench-mark is 25.87 feet above zero.

Elevation of bench-mark and zero of gauge above sea not yet determined. Length of gauge above zero 23.30 feet. The zero point is the low water of 1864, and is 3 feet above the bed of the river. Its elevation above sca-level is 474 feet. Depth of water below zero about 3 feet. Danger line on gauge, 12 feet, and when the water reaches this point the low-lands on both sides of the river begin to overflow. The area subject to overflow at this stage is 40,000 acres on the Illinois side, and something over that on the Missouri side. This stage endangers farming interests. At 18 feet other property, such as houses, stock, &c., are endangered, especially stock. Floods from the Des Moines and Fox Rivers are generally very sudden.

The greatest danger is from ice when the river breaks up.

Louisiana, Mo.—The river-gauge is cut on the draw-pier of the bridge, and is the

property of the Chicago and Alton Railroad.

The zero of gauge is 436.23 feet above sea-level. Danger begins at 12 feet. Highest water was in 1851, when it reached 21.94 feet on gauge. United States precise bench mark 24 is a copper bolt set vertically in top surface of stone forming the northeast corner of the west abutment of the railroad bridge at Louisiana. It is 466.61 feet above a-level, and 30.38 feet above zero of gauge.

Beardstown, Ill.—The river-gauge is placed on the draw-pier of the Chicago, Burling-

ton and Quincy Railroad bridge over the Illinois River.

The height of gauge above zero is 24.80 feet. Top of tie on bridge above zero, 34.63 feet.

Zero above sea-level, 423 feet.

United States bench-mark is the top of uppermost stone of northwest corner of foundation of a reddish-brown brick house at the foot of Jefferson street. Elevation above low-water surface, 20.55 feet. Established November 7, 1876, from water-surface benchmark at Frederick.

Highest water occurred in 1882, when it reached 22 feet above zero.

Danger begins at 12 feet, at which height low farming lands are submerged.

Yankton, Dak.—The zero of the river-gauge is the bed of the river, and is 1,176 feet above sea-level.

Danger begins at 24 feet.

Omaha, Nebr.—The zero of river-gauge is low water of 1867.

Elevation above sea-level, 983 feet.

Danger begins at 18 feet.

Platimouth, Nebr.—The zero of the river-gauge is the low water of December 6, 1873. Elevation above sea-level, 908.75 feet.

Danger begins at 16.58 feet.

Leavenworth, Kans.—The zero of the river-gauge is the low water of November, 1871. Elevation of zero above sea-level, 753 feet.

Danger begins at 20 feet.

Highest water was on April 29, 1881, and was 25.83 feet.

Kansas City, Mo.—The zero of gauge is 1.50 feet below low water of December 2, 1874. Elevation above sea-level, 734 feet.

Danger begins at 21 feet.

Highest water was in 1884, 37 feet.

Boonville, Mo.—The zero of the river-gauge is the low water of December 1, 1872.

Elevation above sea-level, 547 feet.

Danger begins at 20 feet.

Ecrmena, Mo.—Zero of gauge, low water of 1878, about 477 feet above sea-level.

Danger begins at 21 feet.

Highest water occurred in May, 1881, 24.58 feet.

Jerome, Mo.—The river-gauge is on the west face of the west trestle of the Saint Louis and San Francisco Railroad bridge over the Gasconada River at this place.

The rail on bridge is 683 feet above sea-level.

The zero of gauge is 27.50 feet below this rail, and 655.50 feet above sea-level.

Saint Louis. Mo.—The river-gauge is the property of the United States Engineers. It is placed at the foot of Market street.

Zero of gauge is 379 feet above sea-level.

Danger begins at 30 feet.

The bench-mark is the city directrix, which is 412.75 feet above sea-level, and 33.75 above the zero of gauge.

U. S. precise bench-mark is a small hole in copper bolt leaded horizontally in the west pier of arch No. 4, on east side of pier of Saint Louis steel bridge. It is 20.14 feet south of north end of pier, and 1.12 feet above top course of granite. The letters "U. S." are cut in the granite below the bench-mark.

Elevation 436.68 feet above sea and 57.68 feet above zero of gauge.

The lowest water recorded at Saint Louis occurred on December 21, 1863, and there is every indication in the record, before and after, that it was occasioned by an ice-gorge. The zero of the river-gauge was placed at this low water of 1863, and has so continued to the present date.

In October, 1871, a regular gauge was established by the Signal Service, and was read for the first time on the 16th of that month; and in 1873 the first permanent gauge was

established.

Before 1871 the record was kept by a Mr. Jacob Leopold. There was no gauge, and the level of the water surface was ascertained by leveling down from the city directrix.

In 1873 the river was for three days 0.14 foot below the zero of the gauge, the river at

that time being closed by ice.

In 1872 the river was below zero for twenty days, when not actually closed by ice, seven of these days, December 5th to 11th, being preceded and followed by a frozen river.

In 1871 it was below zero twenty-seven days-October 16th to November 11th.

Warren, Pa.—The river-gauge is located on the west face of the north abutment of the suspension bridge over the Allegheny River.

The height of gauge above zero is 16 feet, and it is 12 inches wide.

Zero below the top line of abutment, 22.83 feet. Average depth of water over riffle, .83 of a foot. Danger-line begins at about 7 feet on the new gauge.

The elevation of the zero of gauge above sea-level has not been determined.

Oil City, Pa.—The river-gauge is placed on the southeast bank of the river. point is 6 inches above the low water of September, 1880, and is level with the bed of the river on Charles's riffle, the shallowest point between Oil City and Pittsburg. Elevation of Union Depot above sea-level, 1,008 feet.

Elevation of zero above sea-level, about 985 feet.

Highest water occurred on March 17, 1865.

Danger begins at 13 feet, when the water flows into the cellars in the business part of the town.

At 20 feet it flows over some of the streets and endangers two of the bridges which

span the river.

Clarion, Pa.—The river-gauge is located on the north abutment of the Clarion County bridge over the Clarion River. The gange is placed partly on the abutment and partly on a natural rock (the foundation of the abutment), and has a stone 4 feet 6 inches in length planted at the foot of the natural rock, sunk flush with the water-line as it then stood, the top surface of the planted stone being the zero of the gauge. The zero of gauge is 25.58 feet below the top line of the abutment.

Height of gauge above zero, 20 feet.

Average depth of water below zero on Toby Mill riffle, 1 foot.

The exact elevation has not been determined, but it is about 1,052 feet above sea-level. The danger-line has not been exactly ascertained, but is about 10 feet above the zero

of the present gauge.

The observer, Mr. T. W. Raine, reports that the height of water on the gauge will not correspond with height as generally given by rivermen; for example, when there is what is called a 6-inch stage (a stage at which empty crafts can be safely floated) the marks on the gauge show about 28 inches. In extreme low water there are many rocks in the channel that stick up 18 or 20 inches, while all around them there may be a foot or more of water. When the water is 6 inches over the tops of these rocks there is said to be a 6-inch stage. A 2-foot stage is a good rafting stage, and corresponds to 4 feet 2 inches on the gauge.

Mahoning, Pa.—The river-gauge is located on the pier of the Allegheny Valley Railroad bridge across the mouth of Mahoning Creek.

Height of gauge, full length of pier, 29.83 feet above zero.

Width of gauge, 12 inches.

Zero of gauge below the rail on bridge, 33.08 feet.

Elevation of rail above sea-level, 827.55.

Elevation of zero above sea-level, about 794.47 feet.

Average depth of water below zero, 3 feet.

Mahoning Creek drains an area of nearly 400 square miles. Its valley is very narrow and bounded by steep side-hills. The fall is 8 feet per mile.

Any rise from Red Bank Creek, which empties into the Allegheny about 10 miles above, and drains about 650 square miles of area, would first be reported from this

gauge.

Brookville, Pa.—The river-gauge is located on first pier of the Allegheny Valley Railroad bridge over the Red Bank Creek, which point is below the intersection of Red Bank with Sandy Creek.

The gauge extends upward 16 feet above the zero.

Depth of water below zero is 1 foot.

Height of rail on bridge above zero, 40 feet.

Two elevations are given for Brookville by the State Geological Report, namely, 1,234 and 1,211 feet. The lowest one has been adopted as the probable height. Dr. Gannett gives the elevation of the railroad depot as 1,235 feet above sea.

Height of rail above top of pier is 13 feet, and if the elevation of 1,211 feet is accepted,

the elevation of zero above sea-level is 1,173 feet.

Parker's Landing, Pa.—The river-gauge is located on the first pier of bridge over the Allegheny River.

Height of gauge above zero is 30 feet; width of gauge, 12 inches.

Elevation of zero above sea-level, not yet determined.

The zero of gauge is referred to the rail in front of the depot.

Top of planking of bridge roadway below rail, 2.55 feet. Zero of gauge below planking, 36 feet. Top of pier below planking, 4 feet. Zero of gauge below rail, 38.55 feet.

Average depth of water below zero, 1.50 feet.

Zero point is the top line of foundation of pier.

Saltsburg, Pa.—The river-gauge is located on the middle pier of the county bridge over the Kiskiminitas River, below the junction of Connemangh and Loyalliana Rivers.

The zero is referred to two tracks of the railroads, the old Pennsylvania Railroad where it crosses Point street, and is 891 feet above sea-level, and the new or West Pennsylvania Railroad where it crosses Washington street, and is 854 feet above sea-level.

Level of footway on bridge over pier is 855.01 feet above sea-level.

The zero of gauge is the top line of the foundation of pier, and is 26.75 feet below the footway of the bridge, making zero 828.26 feet above sea-level.

The gauge is the full length of the pier, 26 feet.

Average depth of river below zero, 3 feet.

Danger to property, from Saltsburg to the junction of the Kiskiminitas with the Allegheny, is imminent when the water reaches 6 feet on the gauge.

Highest water over known was in 1859, when it nearly reached the bridge, flooding

streets that run parallel with the river.

Johnstown, Pa.—The river-gauge is placed on the first pier of the Johnstown bridge of

the Pennsylvania Railroad.

Bench-mark is the top rail over the gauge, which is referred to a frog at crossing of railroad, the elevation of which above sea-level is 1,184 feet, as furnished by the engineer of the Cambria Iron Works. The bench-mark (this rail) is 5 feet below this frog, or 1,179 feet above sea-level.

The zero of gauge is 31.16 feet below the bench-mark and is the top line of the founda-

tion of bridge pier, and its elevation above sea-level is 1,147.84 feet.

Length of gauge above zero, 15 feet.

Width of gauge, 10 inches.

Zero above bed of river, 2.50 feet.

Danger line begins at 7 feet on the gauge.

Rowlesburg, W. Va.—The river-gauge is located on the center pier of the Baltimore and Ohio Railroad bridge over Cheat River.

Height of gauge above zero, 17 feet.

Height of zero above sea-level, 1,375.34 feet.

Bench-mark of the United States Coast and Geodetic Survey, situated on center pillar west end of the Baltimore and Ohio bridge over Cheat River, is 1,402 feet above sealevel.

Zero of gauge, 26.66 feet below bench-mark.

Morgantown, W. Va.—The river-gauge is located on the north face of the south abutment of bridge over Decker's Creek, 28 feet being on the abutment and 6 feet on a stone planted in the bed of the creek.

The zero point is the same as the old gauge—790 feet above sea-level.

Danger begins at 20 feet.

The Government is building a dam 9 miles below, on the Monongahela River, which it is believed will raise the water 2 feet 9 inches on the new gauge. This rise has not, however, been fully determined.

When the stage of water is zero the bed of the river under the suspension bridge is

Morgantown is the head of the present slackwater improvement now in course of con-

struction by the Government.

Weston, Pa.—The river-gauge is located on the north side of east abutment of the county bridge over the west fork of the Monongahela River, and is partly made of curb, slanting down from the foot of the abutment to the edge of low water.

Height from zero to bridge seat on abutment, 25.41 feet.

The height of zero of gauge above sea-level has not yet been fully determined, but is about 824 feet.

Danger begins at 18 feet on gauge.

Average depth of water in river, 6 inches.

Lock No. 4, Pennsylvania.—The river-gauge is located on the inside face, lower end of river wall of lock, the marks being cut in the stone. This gauge is to be extended when the lock is finished by placing a plank gauge on the upper log-wall of lock. The benchmark is the top surface of the new wall just over the gauge. Its elevation above sealevel is 745.77 feet. The elevation of zero of gauge above sea-level is 719.87 feet. Height of gauge when finished, 40 feet. The zero is intended to be the bottom of the river.

Danger line is 28 feet. The low-water reports are the most important to rivermen.

There is not much danger from high water, as only the creek bottoms are overflowed; the banks on both sides of the river, a short distance from the margin, rise abruptly and to a considerable height. The greatest danger arises from floating ice, which sometimes gorges when the river is not more than from 18 to 20 feet high, and often causes great damage to steamboats and coal-barges.

Pittsburg, Pa.—The zero of the river-gauge is the wharf log at the foot of Market

and is 694 feet above sea-level.

Danger begins at 22 feet.

The observer at Pittsburg reports that the Davis Island Dam, 5 miles below that city, was put in operation October 7, 1885. When the wickets of the dam are raised to their full height the stage of water, as indicated by the station gauge, will be about 6.2 feet. All stages of water below 6.2 feet will be influenced by the operations of the dam.

Freeport, Pa.—The river-guage is placed on the West Pennsylvania Railroad bridge across Buffalo Creek, and is 18 inches above Dock Riffle, one mile above gauge. Height of gauge is 25 feet; the lower end covered about 2 feet by rocks and deposits, so that from 2 feet downward a temporary gauge is located. Above 25 feet the height of water is read by means of a gauge convenient for reference, placed either on the bridge or other prominent point. The zero of gauge is the low water of 1888; elevation above sea-level of railroad track on bridge, 772 feet. Zero of gauge, 31 feet below railroad track, and 741 feet above sea-level. Danger begins at 20 feet, but it would not become general until a height of 25 or 30 feet had been reached. Thirty-five feet would flood all the flats along the river. Buffalo Creek drains an area of about 150 square miles.

Wheeling, W. Va.—The river-gauge is located on the levee, 330 feet north of Twelfth

street. It is made of sandstone, set flush with the surface of the levee, and is marked in feet and quarters of feet. The high-water mark of February, 1884, is the benchmark, and is cut in the stone bottom of "O. G.," on top of water-table on southwest corner of custom-house, corner Sixteenth and Market streets, and is marked "H. W.,

February 7, 1884." Its elevation is 664.66 feet above sea-level.

Elevation of zero of gauge above sea-level, 611.57 feet. Height of gauge above zero, 35 feet. Depth of water below zero, 13 inches. Danger line, 36 feet on gauge.

At 30 feet on gauge the lowlands, both above and below this point, begin to overflow.

At 36 feet the water is backed up in some of the cellars on Main street.

The highest water was in 1884, when it reached 54 feet above the zero of gauge. Marietta, Ohio.—The river-gauge is located on the levee at the foot of Second street.

From 5 feet above zero to 34.50 feet it is made of sandstone. Extensive repairs have been made to the upper portion of this gauge.

The bench-mark is the top of the stone foundation of the southwest corner of a brick house (J. N. Peaker's), which stands on the corner Ohio and Second streets.

The elevation of this bench-mark is 623.05 feet above sea-level.

Elevation of zero above sea-level is 582 feet.

The height of gauge at present above zero is 34.50 feet.

Depth of water below zero is 1.50 feet.

Danger-line on gauge is 25 feet, and when the water reaches this point the low farming lands, both above and below Marietta, begin to overflow, Second and Third streets are under water, and some of the cellars on Front street are filled. A flood of 34 feet in August, 1876, entirely destroyed the crops in the lowlands.

Cincinnati, Ohio. - A new river-gauge is in course of construction, and the zero has not

been determined.

Louisville, Ky.—The river-gauge is located on the levee at the foot of Fourth street. The lower portion, from zero to 26 feet, is made of granite flagging 4½ feet wide, and in length from 4 to 8 feet, embedded in the surface of the levee, with the top surface of the flag flush with the surface of the levee. Down the center of the flagging an iron strap 5 inches wide is fitted and marked in feet and inches, from zero to 26 feet. 26-foot mark the gauge is continued by painted lines and figures on the iron pillar of the Shore Line Railroad trestle up to 47 feet 8 inches.

There are two bench-marks, one located by Mr. J. A. Weise, engineer of the Jeffersonville, Madison and Indianapolis Railroad, who ran a line of levels from a Coast Survey bench-mark on the Ohio and Mississippi Railroad bridge near North Vernon, Ind., and connected with the northeast corner of the Indiana abutment of the Louisville Railroad This bench-mark is 481 feet above sea-level; zero of gauge below this benchmark is 76.68 feet. Another bench-mark has been established on the top surface of the foundation-stone on which the railroad trestle rests, and is 26.20 feet above zero of gauge, and 430.52 feet above sea-level. The zero of the gauge is the bottom of the river in the chute over the falls, and its elevation above sea is 404.32 feet.

The height of gauge above zero is 47 feet 8 inches.

Danger line is 24 feet.

At 24 feet the lowest portions of the city begin to overflow, and Portland, a suburb of Louisville, is very generally under water, and also a large area of lands on both sides of the river, between Louisville and Evansville, is covered with water.

This gauge was constructed for the purpose of knowing the amount of water on the

There is another gauge in the canal at the foot of Tenth street, the zero of which is 2.16 feet below the first mentioned one, and gives the amount of water in the canal. There is also another gauge at the lower end of the canal where it enters the river, below The zero of this gauge is 29.07 feet below the zero of the Fourth street gauge.

The observer reports the amount of water in the canal, and this is the information the steamboat men desire, as they are aware of the difference in the gauges, and knowing this they can tell whether they can go through the chute or will have to take the canal,

and what the water is over the falls.

Evansville, Ind.—The river-gauge is located on the levee at the foot of Main street. At the upper end is a post 12 by 12 inches and 5 feet above ground. From the foot of this post a timber, 4 by 8 inches, with an iron strap, 4 inches by one-half inch, fastened to the top face and marked in feet and tenths, extends to low-water mark.

The bench-mark is the top face of the iron door-sill, on Main street, next to Water, of

a brick house on the corner of Main and Water streets.

Elevation of bench-mark, 368.84 feet above sea-level, and 48.84 feet above zero of the gauge.

Length of gauge above zero, 50 feet.

Depth of water below zero is as follows: At zero there will be 2.50 feet of water on the sand-bar near Henderson's Island, 15 miles below; at Scuffletown Bar, 18 miles above Evansville, there will be 1.50 feet of water.

Danger line, 30 feet. When the water reaches this point the low lands on both sides of the river begin to overflow. At 40 feet, all the low farming lands are submerged, and the town of Hurricane, Ky., is also flooded. When the river reaches 40 feet above zero, nearly the whole of Union township is under water, and from Evansville to Newburg, 12 miles above, tenement houses are in great danger.

Knazville, Tenn.—The river-gauge is located on the second pier of the county bridge,

and is fastened by clamping-pins.

Extreme high water was in 1867 and 1875, and was 39 feet above zero of the gauge.

Extreme low water was in 1871 and 1884, and is the zero of the gauge.

The water has never been so high as to make a danger line.

Chattanooga, Tenn.—The zero of the river-gauge is the low water of September, 1839. The zero of the gauge is 49.9 feet above the Union Depot, and 621 feet above sea-level.

Danger-line is at 33 feet, and at 38 feet many dwellings are flooded.

Burnside, Ky.—The zero of river-gauge is at low-water mark, and its elevation above sea-level is 589 feet.

Danger begins at 30 feet.

Carthage, Tenn. - The river-gauge is placed on the bank of the river as it inclines.

The water rises at Carthage as high as 60 feet.

Danger begins at about 30 feet.

The elevation of zero of gauge is about 443 feet above sea level.

Nashville, Tenn.—The river-gauge belongs to the United States Engineers.

The zero of gauge is the low water of September, 1863, and is 6 inches higher than the river-gauge used previous to May 1, 1884.

The zero of gauge is about 366 feet above sea level.

Danger begins at 40 feet.

Decatur, Ala.—The river-gauge is located on the down-stream end of the south pier of the L. N. S. and N. A. R. B. bridge, to which it is secured by 7 iron bolts wedged in holes drilled in the rocks of the pier. It is made of 4 by 3 inch lumber, painted white, • and graduated from zero to 32 feet, inclusive.

The top of the top course of stone on pier is the bench-mark, and is 571.17 feet above

sea level.

Elevation of zero above sea, 537.51 feet. Length of gauge above zero, 32 feet. Depth

of water below zero, 5 feet.

When the water marks zero on this gauge it will give 16 Danger begins at 21 feet. inches on Bridgeport Bar. When the gauge marks 21 feet danger begins to property on the north side of the river, which is much lower than on the south side. Any rise over this not only endangers crops, but also the stock, and in some very low places the houses are in danger.

Johnsonville, Tenn.—The river-gauge is placed on the north corner of the elevator building, and is made of 5 by 2 cypress lumber, painted white, and graduated from zero

to 50 feet. The bench-mark is a cross, cut in the top surface of the coping of west abutment of

railroad bridge, and marked thus: B. M.

+ Elevation of bench-mark above sea-level, 362.83 feet. Elevation of zero of gauge above sea-level, 318.83 feet. Zero below bench-mark, 44 feet. Length of gauge above zero, 50 feet. Depth of water below zero on Duck River Bar, 15 miles above this point, 3.50 feet. Average depth of channel at Johnsonville, 4 feet.

Danger line, 21 feet, when the low lands on both sides of the river begin to overflo w

crops are endangered, and also stock, on the west side.

The river is navigable all the year as far up as Waterloo, 100 miles above this point. Paducah, Ky.—The river-gauge at Paducah, was erected and is owned by the United States Engineers. It is 6 by 6 inch timber, planted in the ground along the surface of the levee, as the same inclines, from Main street to low-water mark. A strap of iron, 5 inches wide by one-half inch thick, is spiked to the top surface of gauge, and marked in feet and tenths of feet from zero to 48 feet, inclusive; from 48 to 59 feet the gauge is of board 4 by 2 inches, nailed to the southeast side of Fowler, Bro. & Co.'s grocery store. The graduations on this board are marked with copper tacks.

Elevation of zero and the elevation of bench-mark have not yet been determined. The height of gauge above zero is 59 feet. Zero of gauge will give 40 inches of water on Grand Chain, 25 miles below Paducah, and an average depth of 3.50 feet on the bar

in front of the town.

When the water reaches the danger line, 40 feet, the low lands opposite Paducah, and both sides of the river down as far as Cairo, begin to overflow. This overflow only on both sides of the river down as far as Cairo, begin to overflow. endangers farming interests. Property at Metropolis, Joppa, and Ogden's Landing is in danger when the gauge at Paducah marks 44 feet.

Cairo, Ill.—The river-gauge is placed on the levee at the foot of Fourth street.

Zero of gauge is 269.60 feet above sea-level. United States bench-mark is a copper bolt let into the northwest face of the customhouse wall, 23.50 feet from the north corner and 3 feet above the ground, and marked "U.S." thus:

Elevation, 3 16.69 feet above sea-level.

Bench-mark above zero, 47.09 feet.

Danger begins at 40 feet, which will overflow the adjacent lowlands in Missouri and portions of Kentucky, but will not affect the town of Cairo.

At 51.33 feet water would overflow the levee. Highest water, 52.17 feet, occurred in 1883.

Newport, Ark.—The river-gauge is located on the second in-shore pile, west side of the clevator building at Newport, The bench-mark is on the engine-house of the elevator building, cut in the foundation-wall facing the river, and on the west corner; it is marked thus: "B. M."

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The elevation of the bench-mark above sea-level is 228 feet. The rail at depot of Saint Louis, Iron Mountain and Southern Railroad is 232 feet above sea-level.

The zero of the gauge is placed at low-water mark of 1878, when there was only 30 inches of water on the Lower Little Island bar, 45 miles above the mouth of the river. Elevation of zero of gauge above sea-level, 198.128 feet, 29.872 feet below bench-mark, and 33.872 feet below rail.

The length of the river-gauge is 37 feet, extending from 35 feet above zero to 2 feet below it. The danger line is reached when the gauge reads 21.50 feet, at which height low-lands five miles below and ten miles above Newport begin to overflow, and from this point on to the mouth of the river, provided the Little Red or Mississippi Rivers are full. The Mississippi, when bank full, will back the water in the White River as far up as Duvall's Bluff, 173 miles from its mouth, and overflow the adjacent low-lands. Should the White River be high at the same time all the low-lands would be dangerously flooded. The water has never been so low that navigation for regular boats has been stopped between the mouth of the river and Jacksonport, on the White River, and as far as Pocahontas, on the Black River, 145 miles above Jacksonport. At medium high water navigation extends to Forsyth, Mo., 300 miles above Jacksonport, on the White River. At very low water boats will rub at nearly every bar.

Memphis, Tran.—There are two river-gauges at this place—one on the levee, 120 feet south of Jefferson street; the other on the northwest corner of the elevator building. The zeros of the gauges are on the same plane, 182.73 feet above sea-level. Both gauges belong to and are kept in repair by the United States Engineers.

Bench-mark is the door-sill of No. 254 Irvin Block, corner of Second street and Alley.

Elevation of bench-mark above zero, 77.067 feet. United States bench-mark No. 4, on house No. 280 Front street, is 89.012 feet above the zero of gauge.

Average time for high water to reach Memphis from Cairo is 4.30 days; from Memphis to Helena, 2.30 days.

Danger begins at 34 feet.

Highest water occurred in 1883, and was 35.58 feet.

Helena Ark.—The river-gauge belongs to the United States engineers. It is placed on

the right-hand side, on the leg of the elevator.

The bench-mark is a copper bolt in the east front of the Tinney Building, between York and Elm streets. It is 50.098 feet above the zero of gauge. This bench-mark is 190.838 feet above sea-level, and zero of gauge is 140.74 feet above sea-level.

There is a second bench-mark near the railroad depot, consisting of a square stone marked "U.S.," which is 40.65 feet above zero of gauge, and 181.39 feet above sea-

Danger begins at 37 feet.

The highest water occurred April 30, 1886, and was 48.1 feet.

Fort Smith, Ark.—A new river-gauge was built during 1885, and the zero of this gauge was placed at the low water of 1856, which is 7 feet lower than the zero of the old gauge.

The gauge is built of stone curbing.

Readings on this gauge commenced April 1, 1885.

Little Rock, Ark.—The river-gauge is made of 6 by 6 inch timber; it is in good condition, and is 31 feet in length. The gauge is painted white, and the graduations, which are in feet and inches, are marked with black paint both on the face and side. The gauge is fastened to a solid rock, called Little Rock, by three iron bolts, and the foot imbedded in the rock to which it is bolted. Gauge is not perpendicular, but is inclined.

Bench-mark is the curbstone southwest corner of Main and Markham streets, and is

286.814 feet above sea-level.

The zero of gauge is 61.514 below bench-mark.

Elevation above sea, 225.30 feet.

The zero of gauge is also referred to an iron bolt imbedded in the top face of the rock to which the gauge is fastened. This bolt is 8 feet and 4 inches from the gauge in a southwest direction, and the top of the bolt is 25.17 feet above the zero of the gauge.

Danger begins on both sides of the river at 23 feet on the gauge, when plantations 12

miles below and on to the mouth of the river begin to overflow.

At 26 feet danger is very extensive both above and below.

The bottom of the river at Little Rock consists for the most part of shifting sand, and is very changeable. At low water the channel is very crooked, and changes with every rise of the river.

Arkansas City, Ark.—The river-gauge is fastened to a pile at the southeast corner of the elevator building, and belongs to the Mississippi River Commission. The gauge is

made of 8 by 2 inch board, painted white.

Bench-mark is the top surface of a nail driven in the root of a large tree standing in the middle of the street, and is about 250 feet from the Parker House. This bench-mark reads on gauge 44.194 feet. Elevation of zero of gauge above sea-level, 94.97 feet. Danger begins on both sides of the river at 42 feet, when the water is at the foot of the levee

Highest water occurred February 27, 1882, when the gauge marked 47.10 feet. Camden, Ark.—The river-gauge is attached to the down-stream side of a large tree. nearly opposite a Mr. Ritchie's store, and the zero point is 3 feet lower than on the old gauge, which was on the up-stream side of the same tree.

The bench-mark is a granite sill of the easternmost door of Mr. Ritchie's store. Auother bench-mark referred to a mark on the root of a pin oak, about three-quarters of a mile from the gauge, said to have been placed there by Col. James Martin, engineer Texas and Saint Louis Railroad.

Elevation of door-sill bench-mark above sea-level, 132 feet. Elevation of zero of gauge above sea-level, 69.80 feet. Length of gauge above zero, 50 feet. Depth of water below zero, 3 feet. Danger line on gauge is 39 feet.

Highest water was in May, 1882, and would mark 46 feet on new gauge. High water at this place is caused principally by the waters from the Little Missouri River, which empties into the Ouachita River about 48 miles above Camden. The rises are sudden, often as much as 12 or 15 feet in a night.

At 8 feet on the new gauge navigation would be possible. At high water the river is navigable to Arkadelphia, 100 miles above; but Camden is considered as the head of

navigation.

The bottom of the river changes very little, being composed of gravel and hard sand. Girard, La.—The river-gauge is placed on the trestle of the Vicksburg, Shreveport and Pacific Railroad bridge over Bayou Bouf. The zero of gauge is the low-water line of 1884; it is 33.25 feet below the top of rail on bridge, and 11 feet above the water in Length of gauge above zero, 30 feet.

Danger line on gauge, 20 feet. When this point is reached the entire country in the vicinity begins to overflow. The greatest danger is from high water in the Mississippi River, which comes in through the broken levees at Possum Fork and Bennett Clair

crevasse.

The elevation of zero above sea-level has not been determined.

Monroe, La.—The river-gauge is painted on the east pier of the Vicksburg, Shreveport and Pacific Railroad bridge; is 11 feet wide and 47 feet 9 inches high. It was constructed by and belongs to the railroad company; was repainted last year, and can be easily read from the bank.

Danger line for the low-lands below is 40 feet.

The river is navigable at all times for small boats. Navigation of regular packets ceases when the gauge marks 6 feet. Rises are sudden, sometimes 7 feet in twentyfour hours.

The highest water on record, 49.10 feet, occurred in 1874.

The elevation of zero of gauge above sea-level has not been determined.

Vicksburg, Miss.—The river-gauge is located on the elevator building, and is the property of the United States Engineers. There is also one at Kleinston, about 13 mile The harbor of Vicksburg has filled up so much since the gauge was crected as to cover the lower end of the gauge to a height of 17 feet. When the river gets below this stage the gauge at Kleinston is used.

The bench-mark for the Vicksburg gauge is a row of tacks driven into a section of

the gauge, which is fastened on the northwest corner of the Prentiss House.

Elevation of bench-mark above sea, 95.938 feet.

Elevation of zero of gauge, 51.138 feet.

Elevation of zero above sca-level, 44.80 feet.

The zero of gauge at Kleinston is on the same plane with that of Vicksburg. bench-mark for the Kleinston gauge is the head of a spike driven into the top of riverward post of a disused bumping-block, distant 100 feet below Sweeney's saloon at Kleinston.

Elevation of nail above sea-level, 92.911 feet.

Elevation of nail above the zero of gauge, 48.111 feet.

A correction should be applied to the readings of this gauge of -. 40 of a foot, it being that much in error.

Highest water in 1864, which was 52.83 feet.

At 41 feet danger begins to lands on the Louisiana side of the river.

Yazoo City, Miss.—The river-gauge is attached to the right-hand end pile, down stream of the draw-protection of the Yazoo City bridge.

The bench-mark is the bottom of a stone built into the wall of the warehouse of the Parish steamboat line, and marks the high water of 1882.

The elevation of bench-mark and the zero of gauge above sea-level has not yet been The gauge is 41 feet above zero and 2 feet below.

The zero of gauge is 40.80 feet below high water of 1882, and is the low-water line of 1875, when Short Creek Bar, about four miles below Yazoo City, has 21 feet of water over it.

Danger begins on both sides of the river when the gauge marks 29.50 feet.

The water is never so low as to prevent boats from going up as far as Greenwood, 160 miles above Yazoo City. The mouth of Cold Water River, 327 miles above Yazoo City, is considered as the head of navigation.

Fullon, Ark.—The river-gauge is located on the north pier of the Saint Louis, Iron Mountain and Southern Railroad bridge over the Red River. The bench-mark is the top of pier on which the gauge is placed, and is 267.772 feet above sea-level.

Zero of gauge is 229.95 feet above sea-level.

Length of gauge is 35 feet above zero and 3 feet below.

Danger begins at 25 feet, when the lowest lands on both sides of the river begin to overflow. At 32 feet the lowlands in the immediate vicinity of Fulton are overflowed.

The highest recorded water was 32.75 feet in August, 1876.

Skreveport, La.—The river-gauge is made of plank, 2 by 4 inches and 37 feet long, and is placed in a groove on pier 4 of the Vicksburg, Shreveport and Pacific Railroad bridge. The graduations and numbers are marked with brass-head tacks, and are in feet and inches.

The zero of the gauge is the low-water line of 1879.

There is a difference in the elevation above sea-level, as determined by Captain Wood-ruff, United States engineer. He gives the elevation as follows:

High water of 1849 is 180 feet above sea-level.

High water of 1884 read 35.913 feet on the gauge.

Height of zero of gauge above sea, 144.087 feet.

Mr. Fallett, an engineer on the Vicksburg, Shreveport and Pacific Railroad, gives the bench-mark on corner of Commerce and Cotton Streets as 203.26 feet above sea-level, and the low water of 1879 as 43.11 feet below this. This gentleman gives the zero of gauge above sea-level as 160.15 feet.

The lowest water occurred on September 1 and 2, 1881, and was 1 foot and 5 inches

below zero of present gauge.

Danger begins at 29 feet.

Coushatta Chute, Louisiana.—The river-gauge is placed on the bank in front of a Mr. Wilson's house, part being perpendicular and part inclined.

The zero-point is the low water of 1881.

The gauge is graduated to 41 feet above zero.

The elevation above sea-level has not been determined.

Danger begins at 26 feet, at which stage the lowlands about four miles below this place begin to be flooded.

The bishess are to be

The highest water of which any record can be found was in 1883, and would read 31.86 feet on the gauge. Water was said to have been higher in 1866, but no marks can be found.

The gauge was democrat on Japanese 4. 1886, by a steembest rupping into it to such

The gauge was damaged on January 4, 1886, by a steamboat running into it, to such

an extent that it is unserviceable.

Alexandria, La.—The river-gauge is a new one, erected by the United States Engineers last year. It is made of 6 by 8 inch timber, well secured to, and has the same inclination as, the bank. The numbers and graduation lines are marked with copper tacks.

The zero of the gauge is the low water of 1881. Height of gauge, 38 feet.

The highest water on record occurred in 1866, and marks 36.46 feet on the gauge.

The lowest water was 3.70 feet below the zero of the gauge.

Danger begins at 33 feet.

The levees, both above and below Alexandria, are broken, and until they are repaired the land is liable to overflow, and danger would begin at 31 feet. When the levees are in good order danger is not apprehended until the gauge marks 33 feet.

The line of high water of 1866 is marked on a large oak tree standing in the northeast corner of the court-house lot. The mark is made with three nails and two cuts, thus:

000

and is 36.46 feet above the zero of gauge.

The elevation of the zero of gauge above sea-level has not been determined.

Delki, La.—The river-gauge is placed on the north perpendicular post of first trestle west of the turn-table of the Vicksburg, Shreveport and Pacific Railroad bridge over Bayon Mason. The zero is the low-water line of 1881. Zero below the top rail on bridge, 40.75 feet.

The zero of gauge above sca-level has not been determined.

Danger begins at 20 feet.

Highest water was in 1882, and would mark 37.50 feet on gauge. When danger line is reached all the land in the section known as overflow lands begins to overflow. The high water here, as at Girard, is caused by the overflow from the Mississippi River. No danger from the Bayon Mason; all danger arises from the water that comes in from broken levees. Bayon Mason is navigable for small boats 20 miles above. When the river is at a 4-foot stage navigation ceases.

West Melville, La.—The river gauge belongs to the U.S. Engineers.

The zero point is 37 feet below the high water of 1882, and 4 feet below the zero point of gauge at Barber's, near the head of the river. Four feet is the slope of the river between the two points.

Zero below base of rail on the bridge is 44.90 feet.

The high water of 1882 was the highest ever known here.

The gauge is in three sections on the bridge and two on the shore. It is graduated

and numbered up to 50 feet.

The lowest recorded stage of water was in 1884, and marked 3.80 feet on the gauge. The water of 1881 was considerably lower, but there is no record of the poin tit marked

Danger begins at 31 feet, and when the water reaches this stage it overtops the banks on both sides of the river and begins to overflow plantations both above and below this

place.

In 1884, at a 6-foot stage of water, the boats ceased to run, owing to the low water on the bar in the old river. During 1885 another bar formed at the mouth of Red River, which obstructs navigation to a great extent both in Red and Atchafalaya rivers. Dredging on the bar is expected to be completed at an early date. The stage of water at which navigation would be interrupted depends in a great measure upon this work.

Bayou Sara, La.—The river gauge is partly on a pile at the down-stream end of the West Feliciana Railroad wharf and partly on an inclined timber extending into river and

anchored at the bottom.

The bench-mark is a line on the south side of the southwest brick pillar supporting a house occupied by Mr. W. Hand, and is situated near the West Feliciana Railroad depot. The line is marked by three nails driven into the pillar. Elevation above zero, 40 feet.

U. S., B. M., XXXIX is the top of copper bolt in limestone monument at the northeast end of base line, directly opposite Bayou Sara.

Elevation above sea-level, 37.90 feet.

Zero of gauge below bench-mark, 34.71 feet.

Zero of gauge above sea-level, 3.19 feet.

Danger begins at 28 feet when the water reaches the foot of the levees.

New Orleans, La.—The river gauge is placed on a pile, with four piles braced together, forming a protection around it. The gauge is situated in the rear of the ferry wharf at the foot of Canal street.

The bench-mark is a stone marked "X," the city datum point, and is the high water

of 1874. It is 16.12 feet above the zero of gauge and 14.62 feet above sea level.

The zero of gauge is the low-water line of December 30, 1876, and is 1.50 feet below sea level.

Highest water in 1874, which was 16.17 feet.

Danger begins at 13 feet.

Readings on this gauge commenced November 1, 1885, when the zero of gauge was changed from high water of 1874 to the low water of 1876, the new zero. 'Readings are 16.2 feet lower than those made prior to November 1, 1885.

I would most strongly urge that the following be inserted in the estimates of appro-

priations required for this service for the fiscal year ending June 30, 1888: River and flood observations, and expenses incidental thereto, \$13,000. for observers, \$6,679.50; services of river expert, \$1,800; river gauges, \$3,000, and incidentals, \$1,440.50.

Very respectfully, your obedient servant,

F. R. DAY. Second Lieutenant, Signal Corps.

The CHIEF SIGNAL OFFICER OF THE ARMY.

#### APPENDIX 10.

#### RAILWAY WEATHER BULLETIN SERVICE.

This system continues in active operation, and its increasing popularity is made manifest through reports from railroad stations at which the indications are posted for the benefit of the public.

This mode of disseminating the weather predictions is most highly appreciated by the agricultural interests in sections traversed by co-operating railroads, farmers consulting the bulletin at their local railway station, to be guided by its warnings, before be-

ginning the work of the day.

The indications are telegraphed over their lines by co-operating railroad companies each morning, and posted at 1,349 stations throughout the country. A few telegraph and telephone lines have, within the past year, inaugurated this system of distribution of the indications; and reports from their officials show that the success of the undertaking is much beyond their expectations.

A list of railroads and telegraph and telephone lines co-operating in this work is given

below.

List of railroads co-operating with the United States Signal Service and the number of stations on each line at which weather indications were posted for the benefit of the public during the year ending June 30, 1886.

Railroads.	Number of stations.	Railroads.	Number of stations.
Allegheny Valley Atchison, Topeka and Santa Fé Baltimore and Ohio. Baltimore and Potomac. Beliaire, Zanesville and Cincinnati. Boston and Lowell. Boston and Maine. Charleston and Savannah. Chicago and Alton. Chicago and Alton. Cincinnati, Washington and Baltimore (Marietta and Cincinnati Division). Cleveland, Columbus, Cincinnati and Indianapolis. Cincinnati, Washington and Wheeling. Cumberland Valley. Ceveland, Loraine and Wheeling. Cumberland Valley. Detroit, Grand Haven and Milwaukee. Detroit, Lansing and Northern East Tennessee, Virginia and Georgia (Memphis and Charleston Division). Flint and Pere Marquette Grand Rapids and Indiana. Grand Trunk. Huhtington and Broad Top Mountain. Lehigh Valley.	89 4 9 13 65 7 12 39 15 44 7 7 9 4 4 20 7 14 64 13 8 8	Louisville and Nashville New York and New Eng and New York Central and Hudson River Northeastern Northern Central Ohio River Old Colony Pennsylvania Philadelphia and Eric Philadelphia and Eric Philadelphia and Reading Philadelphia, Wilmington and Baltimore Pittsburg, Fort Wayne and Chicago Portland and Ogdensburg Providence and Worcester Richmond and Allegheny Saint Louis and Cairo South Carolina Southern Central United Railroads of New Jersey Washington, Ohio and Western West Jersey Worcester, Nashau and Rochester	87 21 118 20 54 10 14 26 14 20 13 6 42 7 35

List of telegraph and telephone companies co-operating with the United States Signat Service, and number of stations on each line at which weather indications were posted for the benefit of the public on June 30, 1886.

Telegraph and telephone companies.	Number of stations.
Edison Mutual Telegraph Company	16 8
Union and Purcellville Telephone Company	114
Total	145

#### APPENDIX 11.

## REPORT OF OFFICER IN CHARGE OF THE CORRESPONDENCE AND RECORDS DIVISION.

SIGNAL OFFICE, WAR DEPARTMENT, Washington City, August 4, 1886.

SIR: I have the honor to inclose herewith, as usually furnished by the Correspondence and Records Division, for publication in annual report, the following, in duplicate in each case:

(1) List showing number of communications sent from and received at the Signal Office. Washington City (exclusive of telegrams), year ending June 30, 1886.

(2) List of stations inspected, year ending June 30, 1886.

(3) List of places for which stations have been requested, but not established, to June 30, 1886 (not printed).

(4) List showing meteorological data furnished persons for purposes specified, year

ending June 30, 1886.

(5) List of boards of trade, chambers of commerce, and other organizations having meteorological committees to confer with the Chief Signal Officer, June 30, 1886.

Very respectfully, your obedient servant,

B. M. PURSSELL.

Second Lieutenant, Signal Corps, U. S. Army,

The Chief Signal Officer, U. S. Army.

### SIGNAL OFFICE, WAR DEPARTMENT, Washington City, June 10, 1886.

SIR: In compliance with Memorandum No. 167, current series, I have the honor to submit the following concise report upon the work of the Correspondence and Records Division during the fiscal year ending June 30, 1886:

(a) The duties of this division embrace the record of, and action upon, all general and

miscellaneous correspondence, including communications sent and received.

(b) Correspondence relative to, and supervision of, all examinations for enlistment.

(c) The recruiting for the Signal Corps.

(d) The promulgation of all instructions, general and special orders, and circulars

issued by the Chief Signal Officer.

(c) See that the business of the service is conducted in strict accordance with the regulations, and to report all violations of orders and departures from the regulations to the Chief Signal Officer, and carry out his orders thereon.

(f) The examination and supervision of the medical accounts of the men of the Sig-

nal Corps and correspondence relative thereto.

(g) The preparation of data in pension cases of officers and enlisted men of the Sig-

nal Corps during the rebellion.

(h) Keep proper record of examinations and enlistments and personal histories of onlisted men of the Signal Corps and of the appointments, discharges, and resignations of civilian employés.

In relation to the foregoing, I have the honor to report that the general and miscellaneous correspondence of the office has been unusually heavy during the year, but as a rule has been conducted with dispatch, and in a manner satisfactory to all concerned, although at times the force on duty in the division has been insufficient to maintain that promptness and certainty of action so necessary to the transaction of business in the office. The general correspondence indicates unmistakably the increasing and pressing demands for a further extension and improvement of both branches of the Signal Service, meteorological and military. In the meteorological service the principal demands of the general public are for a more extended dissemination of the official predictions of the office, so as to embrace all the small cities, towns, and villages, and for the benefit of special industries, such as cattle-raising in the West, packing and shipping interests, &c.; demands for more stations in the interior of the country, and for special predictions relative to floods, cold waves, frosts, and other abnormal changes, the building of new sea-coast and military-telegraph lines, cable connections, &c.

Special attention has been given to correspondence and examinations relative to the enlistment of recruits for the Signal Corps, and the officer in charge has faithfully endeavored, and he believes with success, to carry out the wishes of the Chief Signal Officer that none but men of the highest order of physical and mental excellence attainable be secured for the vacancies in the ranks of the corps. All enlistments have been made under the strictest application of the civil-service principles embodied in the rules of the Chief Signal Officer governing this matter. The very limited number of instances of misconduct and neglect of duty on the part of the instructed men of the corps during the past year give evidence that the standard of personnel has about reached the maximum. The present state of efficiency can only be maintained by the strictest application of the present rules governing admission to the service. The following table shows the number of examinations, enlistments, promotions, discharges, reductions, deaths, &c., during the year:

### Fiscal year ending June 30, 1886.

Candidates who submitted preliminary examination papers	47
Candidates who appeared for final examination	31
Men enlisted (thirty-eight of whom did not submit preliminary examination papers	
but were examined at office, Washington, D. C.)	69
Men instructed at Fort Myer in the full meteorological and field course	36
Men instructed at Fort Myer as military signalists	30
Promotions to grade of sergeant	32
Promotions to grade of corporal	33
Promotions to grade of first-class private	27
Reductions to ranks	15
Discharges	59
Deceased	4

The instructions and general and special orders of the Chief Signal Officer have been promulgated in printed form from time to time, numbered in separate series, and neatly

bound in volumes at the end of the year.

As a general rule all persons in the service have rendered faithful service, have given ready compliance with the orders of the Chief Signal Officer, and there have been but few derelictions to report, and these of a minor character. Although the five hundred men of the corps are scattered throughout the whole territory of the United States, and many of them are required to serve in severe and unhealthy climates and perform the most arduous duties, yet the general health has been excellent, few cases of severe illness occurring, and, as above stated, only four deaths took place during the year. Most of the sickness was among the men on duty in the office of the Chief Signal Officer.

A considerable portion of the time of one clerk has been given to the preparation of data relating to pensions for officers and enlisted men of the Signal Corps during the rebellion. Attention is invited to the unsafe position of these and other valuable military records of the Signal Corps during the late war. These records are all stored in building No. 1721 G street. This building is not fire-proof, and is surrounded by other rickety

buildings which may burn at any moment.

Careful record has been maintained during the year of the personal history of all members of the corps, so that the merits and demerits and all the particulars affecting the personal and official character of any individual can be placed before the Chief Signal Officer at a moment's notice.

During the year 143 stations of the Signal Service were carefully inspected by officers

of the corps.

Very respectfully, your obedient servant,

B. M. PURSSELL.

Second Lieutenant, Signal Corps, U. S. Army.

The CHIEF SIGNAL OFFICER OF THE ARMY, Washington, D. C.

#### APPENDIX 11A.

Statement exhibiting the communications sent from and received at the Signal Office, Washington City (exclusive of telegrams) from July 1, 1885, to June 30, 1886.

SENT.	
To heads of departments and bureaus	4, 395
To non-commissioned officers in charge of stations, concerning their duties.	19, 155
In reply to applications for establishment of stations	117
To telegraph companies, in reference to transmission of weather reports, the	
erection of telegraph lines, &c	139
	200

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To boards of trade, chambers of commerce, &c	351
To foreign correspondents, relating to simultaneous weather reports	330
To foreign correspondents in general	150
To voluntary observers throughout the United States	10,860
Relative to publications	1, 479 808
Data fornished	387
To postmasters, relative to farmers' bulletins, &c	188
To railroad companies, relative to establishing stations, furnishing indications.	
&c	231
Relative to furnishing meteorological instruments, charts, books, forms, &c.	388 510
Relative to building, sale, repair, &c., of telegraph lines	197
To signal officers, relative to their duties	618
Orders, circulars, instructions, &c	56, 500
To manufacturers and others, in reference to instruments, equipments, &c	10, 909
In reference to quarterly returns of officers, &c	2, 799 1, 867
Miscellaneous	14, 469
-	
Total	126, 847
RECEIVED.	
From heads of departments and bureaus	8, 273
Applications for establishment of new stations	43
and the construction of telegraph lines, &c	396
From boards of trade, chambers of commerce, &c	322
From foreign correspondents.	6, 918
Surgeons' certificates	198
Examination papers (sets)	116
From enlisted men, in reference to their duties	10, 122 925
Returns, accounts, descriptive lists, &c	1, 188
From voluntary observers throughout the United States	10, 860
From United States military posts (surgeons' reports)	678
Relating to duties and discipline at Signal Service school of instruction at	
Fort Myer, Va.	512
Relating to instruction in military signaling	317 589
Instruction reports	2, 244
Reports from railroad stations in reference to weather reports.	17, 808
Meteorological forms, &c., from stations	180, 729
Reports from postmasters in reference to weather bulletins	4, 220
Acknowledgments of orders, circulars, &c.	13, 490
From manufacturers and others, in reference to instruments, equipments, &c.	2,804
From officers, concerning property and money accounts	22, 880 10, 827
-	
Total	302, 218
Total sent	126, 847
Total sent and received	429, 065
. Telegrams.	
Cinher words or reports sent and received	1, 774, 995
Cipher words or reports sent and received	80, 590

# APPENDIX 11 B.

Stations inspected during fiscal year ending June 30, 1886.

Place.	Inspected by—	Date of inspection
Abilene, Tex	Lieut. W. D. Wright, Signal Corps Lieut. J. P. Finley, Signal Corps	September 22, 1885.
lbany, N. Y	Lieut. J. P. Finley, Signal Corps	August 29, 30, 1885.
lpena, Mich	do	September 15, 16, 1895.
Apache, Fort, Ariz	Lieut. R. B. Watkins, Signal Corpsdo	October 27, 28, 1885.
Ash Fork, Ariz	Licut. L. E. Sebree, Signal Corps	September 15, 1886. May 6-8, 1886.
Atlanta, GaAtlantic City, N. J	Lieut, John P. Finley, Signal Corps.	August 17, 1885.
ssinaboine, Fort, Mont	Lieut. F. R. Day, Signal Corps Lieut. L. E. Sebree, Signal Corps Lieut. J. H. Weber, Signal Corps	September 4, 1885.
ugusta, Ga	. Lieut. L. E. Sebree, Signal Corps	May 9, 10, 1886.
Augusta Ga.  Sangor, Me Saltimore, Md Sarnegat City, N. J.  Sennott, Fort, Dak.  Senton, Fort, Mont.  Slemarck, Dak.	. Lieut. J. H. Weber, Signal Corps	May 9, 10, 1896. August 29–31, 1885.
Baltimore, Md	Lieut J. S. Powell, Signal Corps Lieut J. S. Powell, Signal Corps Lieut J. P. Finley, Signal Corps	June 27-29, 1886. August 20, 21, 1885.
Barnegat City, N. J	. Lieut. J. P. Finley, Signal Corps	August 20, 21, 1885.
Bennett, Fort, Dak	. Lieut. F. R. Day, Signal Corps	september 10, 1850.
Senton, Fort, Mont	do	September 8, 1885.
Sismarck, Dak	do	August 16, 1885. September 20–27, 1885.
lantan Masa	de la	September 20-27, 1885. September 14-18, 1885.
Boston, Mass	Lieut D R Wething Signal Corns	
Sownerille Tev	Lieut, R. B. Watkins, Signal Corps Lieut, W. D. Wright, Signal Corps Lieut, J. P. Finley, Signal Corps	October 17, 1885.
Ruffalo N V	Lieut J. P. Rinley Signal Corps	September 5, 6, 1985. September 3, 4, 1885.
Suford, Fort. Dak	Lieut, F. R. Day, Signal Corps	August 20, 1885.
Cairo III	Lieut, J. C. Walshe, Signal Corns	September 22, 1885.
ape Henlopen, Del	Lieut. F. R. Day, Signal Corps Lieut. J. C. Walshe, Signal Corps Lieut. J. P. Finley, Signal Corps	August 7, 8, 1885.
Suford, Fort, Dak	do	August 15, 1885.
edar Keys, Fla	. Lieut, L. E. Sebree, Signal Corps Lieut, J. S. Powell, Signal Corps Lieut, L. E. Sebree, Signal Corps	August 15, 1885. May 20, 21, 1886.
Charlotte, N. C	. Lieut. J. S. Powell, Signal Corps	June 8, 9, 10, 1886.
Charleston, S. C	. Lieut. L. E. Sebree, Signal Corps	May 11-14, 1886.
Chattanooga, Tenn	do	April 23-25, 1886.
Adar Keys, Fla.  Charlotte, N. C.  Charleston, S. C.  Chattanooga, Tenn.  Cheyenne, Wyo.	. Lieut. J. C. Walshe, Signal Corps	September 2, 8, 1885.
hicago, Ill. hicago, Ill. hincoteague, Va. hincoteague, Va. hincoteague, Va. hincoteague, Va. hincoteague, Va. hincoteague, Va.		September 2, 8, 1885. August 7, 8, 1885. August 10, 11, 1885.
hincoteague, Va	Lieut, J. P. Finley, Signal Corps Lieut, J. S. Powell, Signal Corps Lieut, J. P. Finley, Signal Corps Lieut, J. S. Powell, Signal Corps	August 10, 11, 1880.
Incinnati, Unio	Lieut. J. S. Powell, Signal Corps	June 19-21, 1886.
Jeverand, Onio	Lieut, J. P. Finley, Signal Corps	September 6, 7, 1885. June 22, 23, 1886.
Columbus, OliioConcordia, Kans	Lieut I C Welshe Signal Come	Hentomber 14 15 1995
'uster Kort Mont	Lieut F R Day Signal Corps	August 98 90 1885
Custer, Fort, Mont Davenport, Iowa	Lieut J C Walsha Signal Come	September 14, 15, 1885. August 28, 29, 1885. August 22, 1885.
Davis, Fort, Tex	Lieut. W. D. Wright. Signal Corps	September 23, 1885.
Davis, Fort, Tex Deadwood, Dak	Lieut, F. R. Day, Signal Corns	September 23, 1885. September 23, 1885.
Denver. Colo	Licut. J. C. Walshe, Signal Corps Licut. J. C. Walshe, Signal Corps Licut. J. C. Walshe, Signal Corps Licut. W. D. Wright, Signal Corps Licut. F. R. Day, Signal Corps Licut. J. C. Walshe, Signal Corps	September 3, 4, 1885.
Denver, Colo	do	September 3, 4, 1885. August 24, 25, 1885.
Detroit, Mich	Lieut. J. P. Finley, Signal Corps Lieut. J. C. Walshe, Signal Corps	Hentember 12, 18, 1880.
Dodgo City, Kana	.  Lieut. J. C. Walshe, Signal Corps	September 12, 13, 1885.
Jubuque, 10w8	THE PARTY OF THE P	September 12, 13, 1885, August 20, 21, 1885.
Ouluth, Minn	Tient I II Weber Pleast Com	August 19, 1885. August 25-27, 1885. October 7, 8, 1885. October 18, 19, 1885.
Castport, Me	Lieut, J. H. Weber, Signal Corps Lieut, W. D. Wright, Signal Corps Lieut, R. B. Watkins, Signal Corps	October 7 8 1995
El Paso, Tex	Lieut R R Watking Signal Corps	October 18 10 1895
Frie, Pa	Lent J. P. Finley Signal Corns	September 5, 6, 1885.
Scanaba, Mich	Lieut. J. P. Finley, Signal Corps. Lieut. J. C. Walshe, Signal Corps. Lieut. W. D. Wright, Signal Corps. Lieut. J. P. Finley, Signal Corps.	August 12 13 1885.
lalveston Toy	Lieut, W. D. Wright, Signal Corps.	August 12, 13, 1885. August 24-26, 1885.
Frand Haven, Mich	Lieut, J. P. Finley, Signal Corps	September 19, 20, 1885. October 11, 12, 1885.
rant, Fort, Ariz	Lieut, R. B. Watkins, Signal Corps.,	October 11, 12, 1885.
Frant, Fort, Ariz Freencastle, Ind	Lieut, R. B. Watkins, Signal Corps Lieut, J. S. Powell, Signal Corps	June 10, 1880.
Iclena, Mont	Lieut, F. R. Day, Signal Corps	August 31, 1885.
Iuron, Dak	do	September 17, 1885.
ndianapolis, Indndianola, Tex	Lieut. J. S. Powell, Signal Corps	June 17, 18, 1886.
ndianola, Tex	Lieut, J. S. Powell, Signal Corps Lieut, W. D. Wright, Signal Corps Lieut, L. E. Sebree, Signal Corps	June 17, 18, 1896. August 27–29, 1886.
acksonville, Fla	. Lieut, L. E. Sebree, Signal Corps	May 17-19, 1886. August 23, 1885. May 26, 27, 1886. August 10, 1885.
Keokuk, Iowa Key West, Fla	Lieut, J. C. Walshe, Signal Corps Lieut, L. E. Sebree, Signal Corps Lieut, W. D. Wright, Signal Corps	August 23, 1885.
Cy west, ris	Lieut, L. E. Sebree, Signal Corps	May 20, 27, 1880.
Cnoxville, Tenn	Lieut, J. C. Walshe, Signal Corps	August 19, 1885.
amar, Mo		September 17, 1885.
Ava, N. Mex	Lient P R Watking Signal Corns	October 19, 1885.
cavenworth, Kans	Leut J. C. Walshe Signal Corps	September 15, 16, 1885.
ittle Rock. Ark	Lieut, W. D. Wright, Signal Corps.	August 15, 16, 1885.
ittle Rock, Arkittle Egg Harbor, N. J	Lieut, J. P. Finley, Signal Corps	August 15, 16, 1885. August 19, 1885.
		September 21-23, 1885,
ouisville, Ky	Lieut, J. S. Powell, Signal Corps Lieut, W. D. Wright, Signal Corps Lieut, R. B. Watkins, Signal Corps	June 13, 14, 1896.
ouisville, Ky	Lieut, W. D. Wright, Signal Corps.	August 9, 1885.
Contell, Fort, Ariz	Lieut, R. B. Watkins, Signal Corps	August 9, 1885. October 7, 1885.
Mackinaw City, Mich	Lieut, J. P. Finley, Signal Corps	September 18, 1885.
Maginnis, Fort, Mont	Lieut, F. R. Day, Signal Corps	August 25, 26, 1885.
18718. TCX	. Lieut. W. D. Wright. Signal Corns	September 16, 17, 1883.
daricopa, Ariz	Lieut, R. B. Watkins, Signal Corps	October 6, 1885.
Maricopa, Ariz Marquette, Mich Marine Agency, Philadelphia	Lieut, J. P. Finley, Signal Corps Lieut, F. R. Day, Signal Corps Lieut, W. D. Wright, Signal Corps Lieut, R. B. Watkins, Signal Corps Lieut, J. C. Walshe, Signal Corps Lieut, J. Et Lieut, Signal Corps.	August 13, 14, 1885.
narino Agency, Philadelphia	Lieut. J. F. Filliey, Signal Corps	August —, 1885. August 26-29, 1885.
Marine Agency, New York	do	August 25-29, 1885.
City.		

# Stations inspected during fiscal year ending June 30, 1886—Continued.

Place.	Inspected by-	Date of inspection.
Milwaukee, Wis	Lieut I C Walsha Signal Corns	August 0 10 1005
Mobile, Ala	Lieut, J. C. Walshe, Signal Corps	August 9, 10, 1885,
Montgomery, Ala	Lieut. L. E. Sebree, Signal Corps	June 7, 8, 1886.
Montrose, Colo	Lieut, J. C. Walshe, Signal Corps	April 20-22, 1886.
Moorhead, Minn	Lieut, J. C., Waishe, Signal Corps	September 9, 10, 1885.
Mount Washington, N. H.	Lieut, F. R. Day, Signal Corps	August 10, 1885,
Narragement Dias D T		September 4-6, 1885.
Narragansett Pier, R. I	Lieut, W. D. Wright, Signal Corps	October 1, 1885,
Nashville, Tenn	Lieut, W. D. Wright, Signal Corps	August 11, 12, 1885.
New Haven, Conn		October 7-9, 1885.
New London, Conn	do,	October 2-5, 1885.
New Orleans, La	Lieut, L. E. Sebree, Signal Corps	June 3-6, 1886.
New York City, N. Y	Lieut. J. P. Finley, Signal Corps	August 24, 25, 1885, June 4-7, 1886.
Norfolk, Va	Lieut, J. S. Powell, Signal Corps	June 4-7, 1886.
North Platte, Nebr	Lieut, J. C. Walsho, Signal Corns	September 1 9 1885
Ocean City, Md	Lieut. J. P. Finley, Signal Corps Lieut. J. C. Walshe, Signal Corps	August 9, 10, 1885,
Omaha, Nebr	Lieut, J. C. Walshe, Signal Corns.	August 26, 27, 1885.
Oswego, N. Y.		August 31, September 1, 188
Palestine, Tex	Lieut, W. D. Wright, Signal Corps	August 22, 1885.
Pensacola, Fla	Lieut. L. E. Sebree, Signal Corps	January 10, 1885.
Philadelphia, Pa	Lieut. J. P. Finley, Signal Corps	August 12, 13, 1885.
Phonix, Ariz	Lieut. R. B. Watkins, Signal Corps	Outober 7 1995
Pike's Peak, Colo	Lient I C Walsho Simus Corps	October 7, 1885.
Pittshurg Pa	Lieut, J. C. Walshe, Signal Corps Lieut, J. S. Powell, Signal Corps	September 5-8, 1985.
Point Judith, R. I	Lieut, J.S. Fowell, Signal Corps	June 23-26, 1886.
Poplar Direct Mont	Lieut, J. H. Weber, Signal Corps	September 30, 1885.
Poplar River, Mont	Lieut, F. R. Day, Signal Corps	August 21, 1885.
Port Huron, Mich	Lieut, J. P. Finley, Signal Corps	September 13, 14, 1885.
Prescott, Ariz	Lieut, R. B. Watkins, Signal Corps	November 4-6, 1885.
Reno, Fort, Ind. T	Lieut, W. D. Wright, Signal Corps	September 28, 29, 1885.
Rio Grande City, Tex	do	September 8, 9, 1885.
Rochester, N. Y.	Lieut, J. P. Finley, Signal Corps	September 1-3, 1885.
caint Paul, Minn	Lieut, J. C. Walshe, Signal Corps	August 18, 1885.
Saint Vincent, Minn	Lieut, F. R. Day, Signal Corps	August 11, 1885.
Saint Louis, Mo	Lieut. J. C. Walshe, Signal Corps	September 19-21, 1885.
San Antonio, Tex.	Lieut, W. D. Wright, Signal Corps	September 12-14, 1885.
San Carlos, Ariz	Lieut, R. B. Watkins, Signal Corps	October 14, 15, 1885.
San Diego, Cal	do	September 28-30, 1885,
Sandy Hook, N. J.	Lieut, J. P. Finley, Signal Corps	August 22, 23, 1885,
sundusky, Ohio	do	September 7, 8, 1885,
anford, Fla	Lieut, L. E. Sebree, Signal Corps	May 23, 24, 1886,
an Luis Obispo, Cal	Lieut, R. B. Watkins, Signal Corps	September 25, 26, 1885,
anta Fé, N. Mex	dodo	October 24, 1885,
avannah, Ga	Lieut, L. E. Sebree, Signal Corps	May 15, 16, 1886.
haw, Fort, Mont	Lieut. F. R. Day, Signal Corps	
breveport, La	Lieut. W. D. Wright, Signal Corps	September 2, 1885, August 20, 21, 1885,
brevenort La	Lieut, L. E. Sebree, Signal Corps	
Sireveport, La.	Lieut W. D. Wright, Signal Corps	April 12, 13, 1886.
mith, Fort, Ark		September 25, 26, 1885,
pringfield TH	Time VS D - 10 St - VG	August 17, 18, 1885.
pringfield, III	Lieut, J.S. Powell, Signal Corps	June 15, 1886,
tanton, Fort, N. Mex	Lieut, R. B. Watkins, Signal Corps	October 21, 22, 1885.
lockton, Furt, Tex	Lieut, W. D. Wright, Signal Corps	September 20, 21, 1885.
ally, Fort, Dak	Lieut, F. R. Day, Signal Corps	September 15, 16, 1885.
upply, Fort, Ind. T	Lieut, W. D. Wright, Signal Corps Lieut, R. B. Watkins, Signal Corps	October 4, 5, 1885,
homas, Fort, Ariz	Lieut, R. B. Watkins, Signal Corps	October 13, 14, 1885.
oledo, Ohiootten, Fort, Dak	Lieut, J. P. Finley, Signal Corps	September 8, 9,1885,
otten, Fort, Dak	Lieut. F. R. Day, Signal Corps	August 13, 14, 1885.
Mentine, Nebr	Lieut, J. C. Walshe, Signal Corps	August 29, 30, 1885,
cksburg, Miss	Lieut, L. E. Sebree, Signal Corps	April 14-18, 1886.
est Las Animas, Colo	Lieut, J. C. Walshe, Signal Corps	September 11, 1885,
ickenburg, Ariz	Lieut, R. B. Watkins, Signal Corps	November 26, 1885,
Illeox, Ariz	do	October 10, 1885.
ankton, Dak	Lieut F R Day Signal Corns	September 19, 1885.
ales, Fort, Dak	do.	September 11, 1885.
uma, Ariz	Lieut, R. B. Watkins, Signal Corps	October 5, 1885.
	secondar to transmissingual Corps	OCTOBET 0, 1000.

# APPENDIX 11 c.

Meteorological data were furnished 227 different persons during the year ending June 30, 1886, at their request, for the following purposes, viz.:
To be used in State or United States courts as evidence.

To be used in compiling works or publications on meteorology, hygiene, agriculture, manufactures, commerce, &c.

To assist in manufactures, the prosecution of the arts, and advancement of the sciences. To settle questions as to the relations of meteorology and agriculture.

In deciding the cause and locating the responsibility in railroad and marine disasters. In fixing the responsibility of damage to freight in transit by common carriers.

In acquainting immigrants with the climatology of districts open to settlement. In informing invalids of the desirability of the meteorology of sections affecting their

Miscellaneous purposes.

# APPENDIX 11 D.

List of boards of trade, chambers of commerce, and other organizations which had, on June 30, 1886, meteorological committees to confer with the Chief Signal Officer of the Army.

Place.	Name of organization.	Committees.
Albany, N. Y	Board of Trade	Charles B. Tillinghast, Edward A. Du-
Alpens, Mich	Board of Underwriters	rant, J. Townsend Lansing. Henry S. Seage, John N. Kelley, J. D. Holmes, B. F. Luce, Charles H. Luce. Dr. A. C. Kinney.
Astoria, Oreg	Astoria Chamber of Com- merce.	Dr. A. C. Kinney.
Atlanta, Ga	Chamber of Commerce	B. W. Frobel, J. T. Henderson, R. J.
Augusta, Ga	Augusta Cotton Exchange.	Redding. W. N. Mercier, F. W. Foster, W. W. Bussey.
Baltimore, Md	Board of Trade	Bussey. George J. Appold, D. L. Bartlett, Germon H. Hunt, Frank H. Jenkins, D.
Block Island, R. I	L	T. Buzby. B. B. Mitchell, Ray S. Littlefield, Charles E. Perry. Prof. William H. Niles, Jacob A. Dresser,
Boston, Mass	Society of Arts	(learne I. Pohente
Buffalo, N. Y	Merchants' Exchange	George L. Roberts. Nathan C. Simons, Frank W. Fiske Charles H. Arthur. L. S. Musdock F. W. Damson I. I. Shon
Charleston, S. C	Chamber of Commerce	J. S. Murdock, F. W. Dawson, J. L. Shep pard.
Do	Merchants' Exchange	George W. Bell, T. Follett Ware, John Dougherty
Charlotte, N. C	Chamber of Commerce	T. K. Drawton S. A. Cohan W. W. Wlem.
Chattanooga, Tenn	Iron, Coal, and Manufact- urers' Association.	ming. D. W. Chase, R. C. McRee, F. J. Bennett Tomlinson Fort, G. M. Sherwood, L. M. Clark, A. S. Ochs. W. S. Savarns, G. Parker, N.
Chicago, Ill	Board of Trade	M Neeld
Cincinnati, Ohio	portation committee.	T. F. Livezey, Geo. C. Clements, Chas H. Law, Alexander Hill, A. M. Dolph R. K. Winslow, chairman; R. T. Lyon
Cleveland, Ohio	Board of Trade	R. K. Winslow, chairman; R. T. Lyon Capt. W. B. Guyles.
Concordia, Kans	do	Capt. W. B. Guyles. Geo. W. Twiss, George Cole, C. W. Ross B. H. McEckron, Theo. Laing, Prof. T Sawhill.
Denver, Colo	Chamber of Commerce	Chas. F. Wilson, Herman Silver, C. H
Des Moines, Iowa	Board of Trade	J. P. Bushnell, secretary; S. A. Robert
Detroit, Mich Dubuque, Iowa	do	J. P. Bushnell, secretary; S. A. Robert son, W. A. Warfield T. P. Hall, J. W. Flynn. Dr. A. Horr, T. W. Ruete, S. M. Lang
Duluth, Minn	do	worthy. Walter Van Brunt, Owen Farguson Benj. R. Clarkson. H. S. Jones, J. J. Wadsworth, H. Beck
Erie, Pa	do	H. S. Jones, J. J. Wadsworth, H. Beck
Escanaba, Mich	City	man. John Power, John C. Van Duzen, Wm R. Northup, J. H. Mead, W. W. Mulli-
Grand Haven, Mich		ken. Hon. Dwight Cutler, T. W. Kirby, William Wallace.
Huron, Dak	Board of Trade	John Cain, Augustine Dovis, Hon. Geo.
Indianapolis, Ind	do	W. Sterling. George W. Sloan, A. J. Halford, Jas. R. Carnehan.
Indianola, Tex Jacksonville, Fla	Jacksonville Board of	H. J. Huck, Emile Reiffert, David Lewis, Dr. A. S. Baldwin, Messrs Reed, Clark Owen, and Fuerlie.
Key West, Fla	Trade. Board of Trade	M. L. Hellings, Dr. J. Y. Porter, G. F. Ferguson, Chas. Howe, J. Fogerty.
La Crosse, Wis	do	D. A. McDonald, John Rau, J. H. Sier
Leavenworth, Kans	do	man. Dr. R. J. Brown, Judge L. Hawn, L.
Little Rock, Ark	Cotton and Produce Ex- change.	Mayo. Logan H. Roots, chairman; John C. Fletcher, John D. Adams, R. H. Far
Los Angeles, Cal	Los Angeles Board of Trade.	quhar. Eugene Germain, Vinton L. Mitchell, W.
Louisville, Ky	Board of Trade	A. Clinton. Wm. Cornwall, jr., J. B. Speed, Graham
Do	Polytechnic Society	Wilder, J. A. Tanner, E. H. Bowen Nick Frazer, R. M. Kelly. E. A. Grant, M. D., LL. D.; Prof. J. A. Tanner, M. D.; Prof. H. W. Watson Ph. D.

List of boards of trade, chambers of commerce, and other organizations, &c.—Continued.

Place.	Name of organization.	Committees,
Lynchburg, Va	Chamber of Commerce	R. H. T. Adams, Joseph Cohn, William Hunt.
Memphis, Tenn	Cotton Exchange	D. P. Hadden, John D. Milburn, J. J. Freeman, H. A. Hamilton, M. Gavin, James Yonge, L. A. Scarbrough, A. A. Paton, John Overlon, Jr., B. J. Semmes.
Do Milwaukee, Wis	Merchants' Exchange Milwaukee Chamber of Commerce.	P. Phillips, John Weller, G. H. Peters. John L. Hathaway, John B. Merrill, David Vance.
Mobile, Ala	Mobile Cotton Exchange	W. H. Gardner, Adolph Proskaner, D.
Do	Mobile Chamber of Com- merce.	F. Huger. Hon. Peter Hamilton, W. H. Gardner, E. O. Zadek.
Nashville, Tenn	Merchants' Exchange	J. W. Hopkins, F. D. Hicks (chairman), H. W. Grantland.
New Haven, Conn	Chamber of Commerce City of New London	James Fitch, George T. Marshall, H. S. Bartlett, E. A. Delaney, R. M. Walter- man, Leonard Smith.
New Orleans, La	Cotton Exchange	James A. Renshaw, chairman; J. L. McLean, R. S. Day, J. P. Dobbins, J. T. Brodnax, H. J. Roman, C. H. Al-
Do	Produce Exchange	
New York City, N. Y	Sugar Exchange  Cotton Exchange	J. Barkley, B. M. King, W. B. Bloom- field, P. Lanaux, W. Henderson. Walter T. Miller, James F. Maury, Will- iam P. Campbell. John N. Vaughan, Adam Tredwell.
Norfolk, Va	Norfolk and Portsmouth	iam P. Campbell. John N. Vaughan, Adam Tredwell.
Omaha, Nebr	Cotton Exchange. Board of Trade	
Oswego, N. Y	Board of Trade	C. F. Goodman, F. Rosewater, G. C. Ames, Thomas Gibson, Joseph Barker, J. L. McWhorter, A. S. Failing, W. R.
Pensacola, Fla	Board of Trade and Ex-	Hosmer. Hon, S. C. Cobb, Hon, I. M. Tarble, H. Bears.
Philadelphia, Pa	Philadelphia Maritime Ex- change.	Charles Gibbons, jr., William A. Platt, J. E. Morse.
Pittsburg, Pa	Coal Exchange	Richard Barrows, M. E. Lynn, John W. Risher.
Portland, Me	Board of Trade	C. H. Farley, M. N. Rich, William Sen-
Portland, Oreg	Chamber of Commerce and Board of Trade.	ter. Rev. Dr. George H. Atkinson, E. H. Page, George H. Himes. John Siddons, H. S. Hebard, George
Rochester, N. Y	Merchante' Exchange	Schofield.
San Diego, Cal	Society of Natural History.  Board of Trade and city	Dr. G. W. Barnes, Dr. H. W. Gould, C. J. Fox. J. O. Moss, C. N. Ryan, R. B. Hubbard.
San Francisco, Cal	council. Chamber of Commerce	William L. Merry, Jacob S. Tabor, W.
Strannah, Ga	Savannah Cotton Ex-	W. Dodge. C.M. Holst, A. L. Hartridge, J. J. Wilder.
Shreveport, La	change. Cotton Exchange	H. R. Johnston, R. E. Jacobs, Henry Flor-
Saint Louis, Mo	Merchante' Exchange	sheim.  M. M. McKeen, C. L. Case, H. B. Jenkins, James E. Blythe, J. P. Burdean, R. E. M. Bain, F. E. Kaufman.  R. B. Whittemore, Henry Dureker, Chas. Blenonstock, William Mathews, C. A. Lawton, C. W. Simmons.  Daniel Evans Anthony, Utanes, F. C. P. Daniel Evans, Anthony, Utanes, F. C. P.
Do	Cotton Exchange	R. B. Whittemore, Henry Dureker, Chas. Bienonstock, William Mathews, C. A.
Do	Mechanics' Exchange	Feedermann, Thomas Rich, Thomas F.
Saint Paul, Minn	Saint Paul Chamber of Commerce	Hayden. R. O. Sweeney, Rev. David Breed, M. N. Kellog.
Toledo, Ohio	Toledo Produce Exchange	Kellog. W. T. Carrington, Frank I. Young, W. Cummings.
Vicksburg, Miss	Oity	Thomas Mount, Dr. G. W. Howard, J. D. Tinney.
Wilmington, N. C	Chamber of Commerce	F.W. Kerchner, George Harriss, William L. DeRosset.
Yankton, Dak	City	J. C. McVay, chairman, president First National Bank; A. W. Barber, H. G. Clark.

#### APPENDIX 12.

ANNUAL REPORT OF THE OFFICER IN CHARGE OF THE STATIONS DI-VISION.

> SIGNAL OFFICE, WAR DEPARTMENT. Washington City, June 30, 1886.

SIR: I have the honor to submit the following report on the work of the Stations Di-

vision during the year ending this day:

Owing to the extension of the various branches under the supervision of the Stations Division, the importance and amount of the work accomplished during this year have been in excess of that in any previous year.

The routine duties in the several subdivisions have been carefully and accurately performed and, notwithstanding that the clerical force has been reduced by four men, owing to the untiring perseverance of the men on duty in the division everything has been kept

up, and the routine work is fairly well up to date.

So many requests for meteorological data have been received from boards of trade, cotton exchanges, corporations, and from other bureaus of the Government and the Mississippi River Commission, as well as for use in court, for publication, &c., &c., that, had all applications been favorably acted upon, at least ten clerks would have been kept constantly occupied in compiling the information from the records at this office. Consequently many persons had to be refused, and yet during the year the time consumed in preparing data for purposes not connected with the Signal Service was equal to the work of one clerk for three hundred and fifty-five days.

The river system has been enlarged, and new points of observation established at places selected by those most interested in river navigation, and reports of sudden rises and floods have been telegraphed and spread broadcast over the area likely to be overflowed or damaged in any way by high water. Much more could have been done in this direction

if sufficient means for the purpose had been at the disposal of the Service.

Many river-gauges have been erected and replaced, but I regret to say that many others could not be given the attention their importance demanded, owing to the fact that the appropriation was insufficient. River observations are now taken at 95 regular and special stations.

The appropriation for this service for the fiscal year ending June 30, 1886, was not sufficient to meet all the needs of this branch of the service during that year, but in spite of this, valuable warnings were given to all flood-threatened districts, and, as a result, a vast

amount of property was saved.

This work has proven to be of great value to the people living near our great rivers, and its extension to the smaller streams of the country, particularly on the Gulf and Atlantic seaboards, is loudly demanded by the people who have suffered from floods in those districts; but this is utterly impracticable without increased appropriations.

The cotton service has been continued as heretofore, but here again lack of money has caused serious embarrassment and prevented any great enlargement of the system. period of observations had to be shortened ten days in order to provide for the payment of the special observers. Petitions and memorials from cotton exchanges, boards of trade, &c., and prominent business men, asking for the extension of this service on a basis of two hundred and fifty stations (payment by the United States of telegraphic tolls and compensation of observers at 50 cents per day) have been received and estimates in accordance with these recommendations submitted, but it is doubtful whether Congress will allow any increase. One hundred and fifty-five stations are now taking and telegraphing these reports over the telegraph lines of railroads, who give this service free of charge to the Government; but, while the establishment and maintenance of the cotton-region reports has given very valuable information to the people engaged in the cotton trade, it has also taught them how much more valuable the results would be if more reliable and complete data could be obtained. Any increase is, however, impossible without largely increased appropriations, so that, by paying for taking the observations and for the telegraphic service, reliability and promptness would be made certain.

The system of cautionary wind signals has received much attention this year, and it has been changed and greatly improved. While the new signal displays are yet only tentative, observers and shipping men generally agree that great advantages, unknown to the old style, will accrue from the new. The display of cautionary wind signals is

now made at one hundred and sixteen points on the seaboard and great lakes.

The weather and temperature display inaugurated last year has met with marked success and seems to meet the popular wants in every way. The display is now made in three hundred and fifteen cities and towns in the United States. At least an equal number of places have applied for the daily weather predictions, which could not be furnished for the reason that this office had no money at its disposal to pay for the telegrams. At all places where these signals are displayed the flags are purchased from private funds subscribed for the purpose. It is estimated that several millions of people have been directly benefited during the year by the display of these daily forecasts. This office has received over fifteen hundred communications on the subject, all of which testified to their great value to the general public.

In addition to the three hundred and fifteen towns to which the messages are sent there is a vast number of villages and cities that receive this information through the medium of the press, the railroads, and the telephone companies, many of whom post indications daily at their stations. In many cases also the mails are used to transmit this informa-

tion.

The cold-wave signal system has continued to grow in public favor, and many and favorable comments have been made by those whose property has been saved by the timely warnings. So flattering have been the reports on this subject, so great the value of the property saved by them, and so numerous have been the requests for these warnings of approaching cold weather, that the office cannot but consider the cold-wave system as one of the most important adjuncts of the Signal Service. Two hundred and eighty-nine cities and towns now receive the benefit of these warnings, and as the press, the railroad, telegraph, and telephone companies distribute these warnings, it is estimated that at least fifteen millions of people have received and been benefited by them.

Appendices (consisting of valuable meteorological tables and reports) are in course of preparation for the annual report, none of which could be omitted without injustice to

the service.

In the face of reduced appropriations, which, if continued, threaten in the near future to bedly cripple this service, its field of usefulness has constantly widened and its work increased day by day until it stands at present the only institution of its kind in the world that by its work saves to the people who receive its benefits annually more than its cost to the Government a hundred-fold. The vast commercial, shipping, and agricultural interests of this country demand that its scope be greatly enlarged; and to this is added the voice of humanity, for its work often results in the saving of human life.

Very respectfully, your obedient servant,

F. R. DAY,

Second Lieutenant Signal Corps, U. S. Army.

The CHIEF SIGNAL OFFICER OF THE ARMY,

Washington, D. 4

## APPENDIX 13.

#### ANNUAL REPORT OF THE OFFICER IN CHARGE OF THE TELEGRAPH DI-VISION.

The regular tri-daily cipher weather reports were received during the year over the wires of the Western Union, International Ocean, Florida, Gulf Coast, and Northwestern Telegraph Companies.

One million seven hundred and seventy-five thousand cipher words of weather reports were received at, and sent from, this office during the year. Eighty thousand five hundred and ninety telegrams other than weather reports were sent and received during the same period.

#### UNITED STATES MILITARY TELEGRAPH LINES.

There were in operation at the beginning of the year 2,781 miles of military telegraph lines under the control of the Chief Signal Officer, with seventy-seven offices at, or in connection with, military posts on the frontier, and operated with a few exceptions by enlisted men of the Signal Corps.

These lines were distributed among the several departments, as follows:

	Beginning of year.	End of year.
Department of Dakota Department of the Missouri Departments of the Columbia and California Department of Arizona Department of Texas Department of the Platte.	Miles. 803 582 512 510 199 85	Miles. 740 582 444 510 124 85
Total	2,781	2, 485

No new lines were built except to shorten the existing line connecting Fort Totten, Dak., with the commercial wires. In this case a line 7 miles long was built from Lakota, Dak., to a point on the old Larimore line, about 35 miles from Fort Totten, and the line east of that point abandoned and sold. The new connection was completed October 20, 1885, reducing the distance from the post to the transfer office to 42 miles, against 68 miles by the old route.

The line between Forts Yates and Sully, Dak., 123 miles long, was abandoned during September, 1885, and sold at public auction. This line stood in need of extensive repairs, which its small value to military interests did not justify the expense of, as both

posts have independent telegraphic outlets.

It having been found impossible to maintain the long span across the Missouri River between Fort Sully and Bennett, Dak., and there being in the opinion of the Department Commander no urgent necessity for maintaining a line between those posts, the proposition to build a new crossing and make other necessary changes was not carried into effect. The line was formally abandoned in October, 1885, and sold at auction.

The abandonment of the post of Fort Lapwai, Idaho, by the military forces rendered the further maintenance of the telegraph line from that post to Dayton, Wash., unnecessary. It operation was discontinued November 30, 1885, and the line sold at auction

January 16, 1886.

The last abandonment of lines during the year was made June 30, 1886, when the operation of the line between Fort Stockton and Davis, Tex., was discontinued in consequence of the abandonment of the post of Fort Stockton. The iron poles in use on that section will be recovered and the remaining material sold at auction.

To sum up: There were in operation at the beginning of the year 2,781 miles of line; new lines built during the year, 7 miles; abandoned, 303 miles; leaving 2,485 miles in operation at the present date.

The following is a brief description of the lines in the several departments:

Department of Dakota.—The lines are operated as detached sections under the supervision of the chief operators. The Bismarck section, 55 miles long, affords telegraphic communication with Forts Abraham Lincoln and Yates. It is in good condition and has worked with a total interruption of but nine days for the entire year.

The Fort Maginnis section, 367 miles, extends from Glendive, Mont., to Fort Maginnis, via Fort Buford and camp on Poplar River. The line has worked remarkably well, considering the rough and desolate country through which most of it passes, and the great length of the repair sections. A few new poles and the resetting of some old ones

will keep this section in good condition for another year.

The Fort Assinaboine section, 208 miles, connects Forts Assinaboine, Benton, and Shaw with the commercial lines at Helena, and is much employed for commercial as well as military business. The total interruption due to breaks and other causes amounted to twenty-nine days and thirteen hours for the entire year. The projected construction of railroads and private lines will probably lead to the sale of this section at an early date.

The Fort Custer, Fort Totten, Fort Sisseton, and Fort Meade sections are short lines connecting each post with the nearest commercial office; the last-named two are equipped with telephones. The change made on the Fort Totten line has already been referred to.

Department of the Missouri. - The several detached sections in this department are as

The Indian Territory section, 438 miles, extends from Dodge City, Kans., to Henrietta, Tex., and furnishes telegraphic outlets to the posts at Fort Supply, Fort Elliott, Cantonment, Fort Reno, and Fort Sill. The military necessity for this line was well illustrated last summer during the Indian and cattle troubles. The line has worked with little more than ordinary interruptions—such as all telegraph lines are liable to and as it has an outlet at each end, there has been very little delay of business on account of breaks. Very extensive repairs were made to the entire section by troops from the several posts under the supervision of the general repairman, resulting in the erection of a large number of iron poles in the place of the wooden ones, and the construction of more durable spans across rivers. It is proposed to gradually replace all wooden poles with iron ones on this section. The greater part of the line in Kansas runs through lands which have been fenced in during late years, and it will be necessary to move the line so it can be patrolled without difficulty.

The Fort Stanton section, 108 miles, is in excellent repair, and, with the exception of 26 miles, built entirely of iron poles. About six hundred of the latter were put in during the past year, and the whole section received general repairs on two occasions. of the remaining wooden poles are of good quality cedar, and will last some time longer. Iron poles will eventually be used on the whole section. The total number of days on

which the line was interrupted from all causes was nineteen.

The Fort Bridger section, 10 miles, was entirely rebuilt with iron poles during November, 1885, and is in excellent condition.

The Fort Union, Fort Wingate, Fort Lewis, and Uncompangre sections are short lines, some of them equipped with telephones, and connect these posts with the nearest railroad telegraph offices. No commercial business is carried over these lines, and their local management is in the hands of the post commanders.

Department of the Columbia and California.—The lines in these departments, excepting the Spokane Falls section, met with frequent interruptions during the past winter, due partly to severe storms and high tides, and partly to the manner of their construction.

The Fort Klamath section, 233 miles, extends from Ashland, Oreg., via Fort Klamath,

Oreg., to Fort Bidwell, Cal., and for a distance of 138 miles runs through a densely timbered, mountainous country, where the wire had to be strung on trees for long distances. Forest fires, high winds, and falling timber cause frequent damage to the line and make this the most difficult section to keep in repair. Strong details from Forts Klamath and Bidwell made extensive general repairs on several occasions during the year, but nothing could be done with the means at command to remove the natural defects and obstacles of a line through such a country. The abandonment of Fort Klamath as a military post on June 30, will still further increase the difficulty of keeping this line in repair, but the line will have to be maintained in the best manner possible, as it furnishes the only outlet for Fort Bidwell.

The Fort Canby section, 28 miles, including 5 miles of cable, worked well until November, when the line on the Washington Territory side of the Columbia River was almost completely wrecked by high winds and washouts. A continuance of bad weather during the winter caused many interruptions, principally due to the washing away of the beach near Scarboro Head. Work is now in progress moving that part of the line back from the beach and out of the reach of storm tides.

The Cape Flattery section, 80 miles, extends from Port Angeles, Wash., to Tatoosh Island, Wash., a cable 2 miles long connecting the island with the mainland. This line also runs through a densely-wooded wilderness, and is therefore subject to many interruptions, which, however, can always be promptly repaired from the intermediate repair stations.

The Fort Canby and Cape Flattery sections are of great value to commercial interest

in reporting the arrival and departure of vessels.

The Spokane Falls section, 91 miles long, connects the posts of Fort Cœur d'Alene, Idaho, and Fort Spokane, Wash., with the transfer office at Spokane Falls. This section has worked well and with but very few interruptions, and is generally in good condition. A large portion of the line west of Spokane Falls runs through fenced-in lands, which greatly impedes the making of necessary repairs. It is proposed to move that part of the line so as to follow the new stage road. The necessary poles and material are now

being collected for this purpose.

The San Francisco harbor line and cables connect the division headquarters at the Presidio with Alcatraz and Angel Islands, and with the posts of Fort Mason and Fort Winfield Scott. The submarine cable between the Presidio and Alcatraz Island, which on December 31, 1884, was for the second time broken by a ship's anchor, was recovered and relaid from Fort Mason during the following September, a want of funds preventing earlier action. At the same time the surplus cable on hand was laid from Angel Island across Raccoon Strait to Point Tiburon, where connection was made with the Western Union wires. This secured a second means of communication with the islands. On March 26, 1886, the Alcatraz cable was for the third time broken by an anchor, making it evident that a direct cable between Alcatraz and the mainland cannot be maintained. It is now proposed to relay this cable from Fort Winfield Scott to Lime Point, and build a land line thence to Point Tiburon, thus securing direct connection with Angel and Alcatraz Islands, via the cables from Point Tiburon to Angel Island, and from the latter to Alcatraz Island.

Department of Arizona.—Lieut. R. B. Watkins, Signal Corps, has remained in charge of the lines in this department during the year, and reports that all sections have been kept in exceptionably good condition at a very small expense, and that the department and post-commanders are entirely satisfied with the efficiency of the military telegraph. Every mile of line on both the Prescott and Fort Apache sections was gone over and thoroughly repaired during the year. More than 800 iron poles and 400 wooden poles were

erected, and hundreds of wooden poles reset.

The Fort Apache section is 216 miles long, and extends from Fort Apache to Fort Bowie, Ariz., with offices at Fort Thomas, San Carlos Agency, Fort Grant, and Willcox, Ariz. Owing to the great military importance of this line during the Apache Indian troubles, the department commander recommends the construction of an additional outlet from Fort Apache to Holbrook, Ariz. This line can be built from material on hand, if troops can cut the poles and do the other necessary labor.

The Prescott section, 280 miles long, extends from Ash Fork to Maricopa, Ariz., and affords a telegraphic outlet, at either end, to department headquarters at Whipple Bar-

racks, and to Forts Verde and McDowell.

Both sections are largely built of iron poles, and are in excellent condition.

Two short telephone lines, operated by the post authorities, connect Forts Lowell and Huachuca with the nearest railroad offices.

Department of Texas.—The two sections in this department were under the control of the chief operators until June 1, 1896, when Lieut. L. E. Sebree, Signal Corps, assumed

charge of them.

The Brownsville section, 100 miles, extends from Rio Grande City, along the Rio Grande River, to Brownsville, Tex., and connects Fort Brown with Fort Ringgold, and with the subposts at Edinburg and Santa Maria. This line is almost entirely on iron poles and has worked satisfactorily during the year. A general repair party will give it a thorough overhauling during the present summer.

The Fort Davis section, up to June 30, 1886, connected Forts Stockton and Davis with the transfer office at Marfa, Tex., a total distance of 97 miles. The abandonment of the line from Fort Stockton to Fort Davis on June 30, already referred to, reduces the length of this section to 22 miles, all of which is on iron poles and in excellent condition.

A short line, operated by a Signal Corps man, connects department headquarters with

the Western Union office at San Antonio.

Department of the Platte.—The line from Fort Robinson, Nebr., to Fort Laramie, Wyo., is the only military line in this department that is operated by the Signal Service. It is in excellent condition and has worked throughout the year with but very few inter-

ruptions. The completion of the railroad wires to and beyond Fort Robinson will per-

mit of the abandonment of this section at an early date.

Mention was made in the last annual report of the proposed construction of two new lines of telegraph during the coming fiscal year, viz.: From Fort Gaston, Cal., to Mad River, Cal.; and from Fort Halleck to Halleck Station, Nev.; but Congress having failed to appropriate the money for this purpose, no action can be taken at present.

The total receipts from tolls for commercial messages transmitted over the military telegraph lines during the year amounted to \$13,203.81; in addition \$22,324.31 was col-

lected at military offices for tolls due the connecting commercial lines.

#### THE SEA-COAST TELEGRAPH LINES.

Owing to the very small appropriation available during the year for the sea-coast lines, nothing could be done towards rebuilding those sections on the New Jersey and North Carolina coasts which had become unserviceable from age and other causes. The lines between Cape Henlopen, Del., and Chincoteague, Va.; Norfolk, Va., and Kitty Hawk, N. C., and between Wilmington and Smithville, N. C., were maintained in operation throughout the year. Direct communication between Kitty Hawk and Wilmington had already ceased since March 3, 1885, owing to a break in the Hatteras cable, and during April, 1886, the repair of the land lines between those points had also to be suspended for want of funds. The Great Egg Harbor (N. J.) cable broke on September 5, 1885, disrupting communication between the two most important offices on that line, and as there was no money to make repairs, the entire line from Barnegat City to Cape May, N. J., was provisionally turned over to the Life-Saving Service for use as a telephone line.

The Block Island cable broke October 14, 1885, and although an urgent deficiency appropriation of \$5,000 was made by Congress to repair it, its condition was found to be

such that nothing short of a new cable can restore communication.

The only addition to the sea-coast lines during the year was the construction of a line of telegraph and submarine cables connecting the island of Nantucket with the mainland via Martha's Vineyard. The cables, 23 miles in length, were laid in November, 1885, and the land lines completed on April 30, 1886. Galvanized iron poles were used for the latter, and a double wire was strung on both islands to permit communication by telephone as well as by Morse instruments. The total length of line and cables is 61 miles.

#### REPORT ON FROST WARNINGS.

#### Annual report of telegraph division, 1885-'86.

The system of special frost warnings for the benefit of tobacco, cranberry, sugar, and

fruit growing districts was continued in operation as organized in 1882.

Upon the urgent application of cranberry growers a new district was added, with Milwaukee as the center of distribution, covering the cranberry marshes in the central counties of Wisconsin, where some 10,000 acres of marshes are under cultivation, producing an average annual crop of 50,000 barrels, valued at from \$7 to \$10 per barrel.

The greatest enemy to the cranberry plant is frost. Various methods have been tried to protect the plant, but the only successful one, and the one now generally applied by all the large growers, is to flood the marshes to the depth of several inches and keep the water in motion. A majority of the cranberry marshes in the country can be thus protected if the grower has from ten to twelve hours' notice of approaching frost. But as this precaution involves more or less expense, trouble, and loss of time, especially during the picking season, it is necessary to use great caution in making frost predictions for the benefit of this industry. An unnecessary alarm may also exhaust the water in the reservoirs which would be needed for a subsequent occasion of real danger. The large producers during the season of danger keep some one constantly on duty at the sluices, who, by observing the temperature and noting conditions favorable to frost, can often anticipate the danger by flooding the meadows. To such the frost warnings issued from this office are of special value, since they are generally in advance of local indications of approaching frost, and by putting the grower on his guard cause him to watch his own instruments more closely to determine whether or not the danger is imminent for his own particular locality.

The entire frost-warning system now embraces twenty-seven centers of distribution to which the warnings are sent from this office, and eight hundred and twenty-two frost stations where the warnings are bulletined and otherwise disseminated as soon as received from the centers. With the ready and efficient co-operation of the railroad and telegraph companies a system of telegraphic circuits has been established for each center, by means of which the warnings can be distributed with the least possible delay. The great

drawback lies in the fact that rapid distribution is necessarily limited to points at or near telegraph stations, but it is expected that with the growing organization of State weather services a more general distribution of frost warnings, by means of signals or

by courier, will be gradually provided for.

The tobacco-growing districts to which warnings are sent are located in the western half of Massachusetts, the State of Connecticut, a portion of Southern New York, the eastern half of Pennsylvania, Central Maryland and Virginia, the western halves of North Carolina and Tennessee, the State of Kentucky, Southern Ohio and Indiana, Eastern Missouri, and the southern part of Central Wisconsin.

Cranberry interests are protected in Central Wisconsin, in Barnstable County, Massachusetts, and along the Camden and Atlantic Railroad in New Jersey.

Frost warnings for the benefit of sugar-growers are distributed in Louisiana from New Orleans as a center, and the fruit-growers of Florida receive warnings from Jacksonville and Sanford. Special messages are also sent from this office to points in North Carolina, South Carolina, Tennessee, and Texas.

There is relatively but little data on hand in the telegraph division from which to determine the actual amount of benefit derived from these warnings; but it is known that their great usefulness is generally acknowledged, and that with increased facilities for distribution and a wider knowledge of the system by those whom it seeks to benefit, their value to the farmer and planter will be immense. Subjoined are some extracts from letters by fruit, cranberry, and tobacco growers received during the year:

From Mr. J. E. Ingraham, president of the South Florida Railroad Company:

"Through your kindness in sending us frost warnings and weather bulletins last winter, there were no doubt many thousand dollars' worth of fruits and vegetables saved that would otherwise have been destroyed. * * * On the 8th instant (Japanery On the 8th instant (January, that would otherwise have been destroyed. 1886), thirty-six hours before the late freeze, we had a telegram from you, as follows: 'Decidedly colder freezing weather to-night in Northern Florida, Alabama, and Tennessee, with a severe cold wave which will overspread the South Atlantic States and Florida during Saturday, and on Sunday damaging frosts as far south as Tampa Bay'—which was promptly bulletined at all telegraph stations on our line."

From Mr. G. R. Morrison, of Tomah, Wis.:

"It would be a difficult matter to determine to an accurate degree the benefits derived from the frost warnings issued to cranberry districts last season. It is safe to say that not less than 10,000 barrels of berries were saved during the season by growers being able to know when frosts would occur. A failure to receive notice of heavy frost would result in heavy damage."

From Mr. C. L. Waite, of Mather, Wis.:

"Messrs. Hoffman, Brooks, Janes, and others say that the Signal Service report was undoubtedly a benefit. Cannot say definitely when it was a benefit, but saved their entire crops at several different times last year from heavy frosts (8,000

From Mr. C. E. Morgan, Madison, Wis.:

"The warnings proved useful on my marshes; they were modified by our hygrometers, which we found a great aid for locality. * * * From my observation and consultation with growers I cannot entertain a doubt but if continued the service will become most useful to the State."

From Mr. A. C. Brooks, of Norway Ridge, Wis.:
"The frost reports were of great value to the cranberry growers of this locality. ing the report of the frost saved my entire stock of cranberries last season (which was

2,100 barrels), and think others are of the same opinion."

The following extract from a letter by Mr. A. C. Mills, of the Millsonia marsh, dated Madison, Wis., March 23, 1886, illustrates the difficulty of making frost predictions for

a district so as to cover every locality in the district, viz.:

The frost warnings were very beneficial where parties had facilities for fighting frost. In my own case the predictions did not come true, except twice, but my neighbors, both southwest and northeast, got hurt pretty bad three or four times, I presume the reason was because there was more fog at my place."

From Mr. L. G. L. Kniffen, of Milwaukee:

"We received the frost warnings at Lafayette, Monroe County, regularly. We flooded the Kniffen and Stillwater marshes five times before picking. there were injurious frosts when warnings were sent. Of the severest frost, we received a warning in the middle of the warmest afternoon of the fall, when by our judgment we could not have expected frost or been prepared. In this case, except for this warning, we might have lost about 1,200 bushels of fine cultivated berries. Mr. Farrar, of Lafayette, had a large amount of sorghum cane in our vicinity; he watched the signals and smudged his cane four nights to save it. The last time the signal came he had burned all of the stumps and wood gathered, and had not the material wherewith to

protect his crop, and lost it. In his case the warnings were timely, his lack of preparation being the only difficulty."

From Mr. G. B. Sacket, of Berlin, Wis.:

"The frost warnings were of great value to me last fall, and also to a number of other cranberry growers in this vicinity. * * * Twice during last September the warnings were the means of my saving by water at least \$10,000 to \$15,000 worth of cranberries. * * * Should say that any year when there is an average crop there could be saved any one night \$100,000 to \$150,000 worth of cranberries on the marshes in this vicinity."

From Mr. Polk Prince, of Guthrie, Ky.:

"Your frost warnings are quite a benefit to tobacco raisers. It has been a very great benefit to us this fall; got notice in time to save remnant of crop from frost."

From Mr. F. S. Adams, Henderson, Ky.:
"The frost warnings sent to this place have been correct in every instance this season. They are of special importance to the tobacco interests in this locality, Henderson being the center and market of one of the largest tobacco-growing countries in the world."

From Mr. F. J. Garrott, of New Providence, Tenn.:

"I was able by your frost warnings to secure all my crop in proper time without damage, and consider them valuable to the farmer."

The above represent only a few of the many commendatory reports received from planters and others interested, but they sufficiently indicate the vast value of the crops that are protected by the present frost-warning service, limited, as it is, in most cases, to the immediate vicinity of telegraph stations. The expenses are trifling in comparison, being confined to the cost of the telegrams at one-half the usual Government rates, and to that of the blanks on which to bulletin the warnings. It would be impracticable for this office to provide for a distribution of the warnings beyond the telegraph and railroad offices, but the formation of local organizations for this purpose should be encouraged. To this end it is recommended that posters be prepared and widely distributed, explaining the object of the frost warnings and the manner of their telegraphic distribution, and urging upon those interested the importance of local co-operation in our efforts to give them the widest possible dissemination. A judicious distribution of Signal Service Notes No. III, "To Foretell Frost," especially among the cranberry growers, is also recommended. These notes will prove a most valuable adjunct to the growers, local observations, and will encourage others to provide themselves with hygrometers as a means of qualifying the general predictions sent from this office.

Respectfully submitted.

F. R. DAY.

Second Lieutenant, Signal Corps, U.S. Army.

OFFICE OF CHIEF SIGNAL OFFICER, July 21, 1886.

## APPENDIX 14.

#### ANNUAL REPORT OF THE PROPERTY AND DISBURSING OFFICER.

SIGNAL OFFICE, WAR DEPARTMENT, Washington City, July 1, 1886.

SIR: I have the honor to submit the following statement of the work of the Property Division for the fiscal year ending June 30, 1886:

#### PERSONNEL.

On July 1, 1885, as per S. O. Nos. 134 and 138, A. G. O., 1885, I relieved Capt. S. M. Mills as Property and Disbursing Officer of the Signal Service.

#### SALES OF MAPS.

One hundred and ninety-one dollars and eighty-nine cents have been received during the year from sales of maps and bulletins, as allowed by the act of Congress approved March 30, 1874, section 227, Revised Statutes.

#### PAY ACCOUNTS OF THE MEN.

In the settlement of accounts room, the pay accounts of the entire corps have been examined and prepared for settlement, aggregating 15,830 accounts.

Under instructions No. 7, S. O., 1886, Second Lieut. J. C. Walshe was detailed as mustering officer, and to him the examination and preparation for settlement of the pay accounts of the corps were turned over.

### OTHER ACCOUNTS SETTLED.

The number of accounts growing out of the disbursements of the regular appropriations expended by this office, settled during the year, has been 7,152, making an average number per month of 596 accounts. This was caused by the large number of stations, and the character of the accounts incurred at each; they being for small items of rent, hire, &c., which required monthly or quarterly settlements.

#### IMPROVED MODES.

The improved modes of administering the duties of this division inaugurated by my predecessor have continued, together with some changes made during the year in order to make the accounts more explicit and technically correct.

It is thought that the accounts now made up and rendered will be satisfactory to the accounting officers of the Treasury Department, and stand the very critical scrutiny which they undergo.

In this connection I would state that no report has been received from the Treasury Department of the examination of the accounts of Capt. S. M. Mills, my predecessor, since March, 1834, inclusive, and no report whatever has been received as to the result

of the examination of my accounts.

Section 273 of the Revised Statutes, third paragraph, requires the Second Comptroller to report to the Secretary of War the official forms to be used in the different offices, for disbursement of public money in said offices, and the manner and form of keeping and

stating accounts of the persons employed therein.

The Second Comptroller, so far as this office is concerned, has never notified to us the

official forms to be used.

#### HOW PAYMEN'S ARE MADE.

One of the reforms instituted by my predecessor was to pay all vouchers by checks drawn to order, and in no case to bearer, that mode being considered the safest, not only

in transmitting money, but it also furnished assurances that the money reached the persons in whose names the checks were drawn for payment. The plan has proved eminently satisfactory.

#### PURCHASE OF INSTRUMENTS BY PRIVATE PERSONS.

The advantages afforded to obtain greater accuracy by having instruments compared with our standards, for which no extra charge is made, still continues to induce many private persons, institutions of learning, &c., whose voluntary work is of great benefit to this service, to purchase instruments through this office, and during the year there have been 280 instruments of various kinds purchased, representing a total cost of \$1,907.25.
These transactions have no connection with the public funds disbursed by me; this

office simply acts as the agent of the manufacturer.

#### INSTRUMENTS PURCHASED FOR OFFICIAL USE AND ISSUED.

One thousand two hundred and fifty-one instruments of various kinds have been purchased during the year for the use of this service, and 1859 instruments have been issued since last report.

#### AVERAGE COST OF MAINTAINING STATIONS OF OBSERVATION.

The average cost of maintaining each station of observation during the year, including the cost of printing stations and additional cost of life-saving stations, but exclusive of the cost of telegraph service, and the pay and allowances of the men on duty at each, has been \$283.88.

#### CORRESPONDENCE.

The total number of letters received during the year was 42,376, an increase over last year of 4,422 letters.

The total number of letters sent was 41,721, and the total number of indorsements

3,044, being an increase of letters sent of 8,725.

Attention is invited to this large increase of correspondence, which, as it represents the labor performed in this division, fully explains why I have on several occasions made application for an increase in the clerical force of the division. In order to keep the work up, it requires a constant strain upon every one connected with the division.

#### SHIPMENTS.

In the packing and shipping room there were 14,672 distinct shipments made, through the Quartermaster's Department, by mail and by express, with but few losses.

#### PACKAGES RECEIVED.

There were received during the year 6,099 packages.

#### MACHINE SHOP.

The usual quantity of work has been done in the machine shop in the manufacture and repair of meteorological instruments and repairs about the office.

#### CARPENTER SHOP.

The carpenter shop has been kept busy in making the necessary boxes for shipping

supplies, &c., and jobbing and repairs about the office.
On October 7, 1885, this office made request for 7,000 feet of lumber on the War Department, to be paid from the appropriation "contingent expenses." This estimate was returned by the Secretary of War with the information that, as the lumber was to be used for packing signal property for shipment to the various stations in the field, the impropriety in the purchase of the lumber for such purpose from the contingent appropriation was evident, and the request was therefore disapproved.

In this connection a letter was addressed to the Secretary of War on October 26, 1885, inviting his attention to the fact that in estimating for the appropriations the item for lumber was included in that for contingent expenses, and nowhere else; it being considered that as the material would be used here and made up into boxes, it belonged properly to that class of expenditures. The decision of the Secretary of War, however, that it was not a proper charge against the appropriation was maintained, and consequently the lumber for making packing-boxes was purchased from the appropriation "observation and report of storms."

A separate estimate for this item, however, was submitted for the fiscal year ending June 30, 1887.

#### LIBRARY.

The library has received during the year, by purchase, exchange, or gift, 797 volumes, and now contains 10,540 volumes.

#### APPROPRIATIONS.

The condition of the appropriations (disbursed by this office) for the fiscal year ending June 30, 1886, with expenditures thereunder, and balances, with probable demands on such balances, as required to be rendered by the act of Congress approved May 1, 1829, is as follows:

1829, is as follows:	- · · · · · · · · · · · · · · · · · · ·	-,
APPROPRIATED.		
Observation and report of storms	\$246,000	00
Signal Service	5, 500	00
Signal Service	24,000	00
EXPENDED.		
Observation and report of storms	96, 019	72
Signal Service	2,511	32
Signal Service Maintenance and repair of military telegraph lines	20, 263	53
BALANCES.		
<del></del>		
Observation and report of storms	149, 980	
Signal Service	2,988	68
Maintenance and repair of military telegraph lines	3, 736	47
PROBABLE DEMANDS.		
Observation and report of storms	126, 980	28
Signal Service	2, 988	RS
Signal Service	3, 736	47
The amounts appropriated under the different heads for the support of Service, United States Army, for the fiscal year ending June 30, 1886, are a Legislative, executive, and judicial:		
Regular clerks, messengers, &c.	\$10,660	00
Scientific experts, clerks, &c	40, 000	00
War	1,069	
Stationery, allotted by the Secretary of War	4,108	
Rent of buildings for Signal Office	7, 500	00
Contingent expenses, allotted by the Secretary of War	7, 417	49
Total	70, 754	
Sundry civil expenses—observation and report of storms:		
Manufacture, purchase, and repair of instruments	10,000	
Telegraphing reports	138,000	
Expenses, storm signals	11,000	
Cotton-belt reports	7,000	
Connection life-saving stations	1,500	
Traterment shelters	2,000	
Instrument shelters	41,500	. M
River and flood reports	10,000	, M
Maps and bulletins	25,000	00
Total		
·		
Maintenance and repair of military telegraph lines	24, 000	00

Pr- 1441 01 10	
Pay, &c., of the Signal Corps:	<b>200 250 00</b>
Pay of officers	\$33,750 00
Pay of enlisted men	200, 151 51
Mileage to officers.	5,000 00 1,200 00
Pay of contract surgeons	
Commutation of quarters to officers	7,200 00
Total	247,301 51
Subsistence Department:	
Subsistence and commutation of rations, Signal Corps	155,000 00
Quartermaster's Department:	
Regular supplies:	
Fuel	6,200 00
Commutation of fuel, at \$9 per month	23,760 00
Commutation of fuel, at \$8 per month	23,040 00
Forage for mules and horses	3,100 00
Forage for officers' horses	1,495 00
Stationery	100 00
Stoves, and repairs to heating apparatus.	400 00
Lights	150 00
Straw for animals	217 00
Straw for officers' horses	109 20
Straw for bedding	67 20
Total	58,638 40
	00,030 10
Incidental expenses:	
Horse and mule shoes	500 00
Shoes and shoeing officers' horses	234 00
Blacksmiths' and other tools	300 00
Veterinary supplies	300 00
Fire apparatus, disinfectants, &c	200 00
Office furniture, Fort Myer	100 00
Total	1,634 00
Interment of officers and men	200 00
Apprehension of deserters	
Tonomortotion	
Transportation:  Materials and funds	25,000 00
Officers and men	8,875 00
Means of, mules	1,000 00
Means of, harness	130 00
Means of, repairs to	500 00
· · · · · · · · · · · · · · · · · · ·	
Total	35,505 00
Barracks and quarters:	
Commutation of quarters	84, 108 00
Work and supplies at Fort Myer	1,500 00
m	
Total	85, 608 00
Clothing, camp, and garrison equipage:	
Six wall-tents, &c	73 89
Issues in kind	2, 800 00
•	
Total	2,873 89
Medical department:	•
Medical attendance and medicines, officers and men, Signal Corps	5,000 00
Medical attendance and medicines, officers with Signal Corps	100 00
Medical and hospital supplies, Fort Myer	700 00

Medical department—Continued.  Medicines from depots, &c	\$1,000 300	
Total	•	
Ordnance, &c., Fort MyerPrinting and binding allotted by the Secretary of War	100 14, 000	00
Support of the Army: Expenses Signal Service, U. S. Army		
Grand total	954, <b>33</b> 5	

#### CLERICAL FORCE.

On July 1, 1885, there were employed in this division 67 men, 35 enlisted and 32 civilian; the latter including messengers and laborers.

On June 30, 1886, there were employed in this division 69 men, 44 enlisted and 25 civilian; the latter including messengers and laborers.

The above shows an increase of 9 enlisted men and a decrease of 7 civilians.

#### TELEGRAPH STATIONS.

At the close of the fiscal year ending June 30, 1885, there were 74 telegraph stations in operation. Thirteen have been closed during the year, 5 transferred to Lieut. L. E. Sebree, Signal Corps, U. S. A., and 5 added, making a total of 61 stations in operation June 30, 1886, reporting to this office.

#### LINE RECEIPTS.

The receipts from the 74 stations during the year were \$21,258.48, of which the sum of \$10,094.06 was collected for and paid to other lines. This latter includes the business done up to and including March 31, 1886.

On March 12, 1886, the Secretary of War rendered a decision directing that instructions be issued to all officers or others receiving private messages for transmission over private lines to keep all receipts for such messages, and to render accounts therefor separate and distinct from receipts for private messages over Government lines. The money thus received should be promptly paid to the proper parties, as has been the custom heretofore.

#### FREE BUSINESS.

The money value of free business (official messages), if paid for, would have been \$12,-817.93.

#### REMARKS ON APPROPRIATIONS.

On January 25, 1886, the Second Comptroller of the Treasury Department published a memorandum criticising the disbursements in the Signal Service, which led to an investigation of the matter, and the Committee on Expenditures in the War Department, to whom the subject was referred, submitted the following:

#### REPORT.

#### [To accompany House Mis. Doc. 255.]

The Committee on Expenditures in the War Department, under a resolution passed in 1886, beg leave to submit the following report:

Your committee have examined many witnesses and papers, and endeavored to fully investigate the alleged illegal and unauthorized expenditure of certain moneys by the Chief of the Signal Service.

Your committee find that this branch of the War Department was created for the purpose of making observations of storms and the weather, and to prepare and furnish the public with daily forecasts of the same. The law has always been silent as to the manner of conducting the details of the operations in this branch of the service, and the legislation requiring these duties is and has been so meager and embraced in such general terms that many disputes have arisen in construing them.

We find that the Chief Signal Officer, in attempting to secure the object of this law, to-wit, "to furnish an accurate forecast of the weather," it became necessary for this bureau to study the courses and speed of storms, to ascertain the temperature of the atmosphere, and make observations at many points. To do this signal stations were required, men assigned to these tasks, reports required to be made by telegraph to the Chief Signal Officer, and from these data forecasts of the weather made up and sent out over the country for the information of the people. To establish and put in motion this system without any precedent or guide was no small task, and your committee are unanimously of opinion that, whatever construction may have been given to the laws, they were made in good faith, with a view of reaching the end intended by Congress.

While your committee do not concur in the constructions given to many of the statutes, nor does your committee find in the letter of the law authority for all the expenditures made, and while we are of opinion that proper economy has not always been observed, yet we are unable to find any instance where there was a corrupt or fraudulent misapplication of the public moneys, excepting certain items amounting to about \$200,000 paid out under the immediate orders of Captain Howgate while he was acting as disbursing officer of the Signal Service. Your committee find the Department of Justice has taken jurisdiction over all these matters, and has instituted civil and criminal proceedings against the guilty parties, and for these reasons your committee decline to take cognizance of any of these matters.

Your committee are of opinion, and to that end recommend, that additional legislation should be enacted more fully defining the duties and prescribing the scope of this branch of the public service, and thus prevent extravagance and erroneous constructions being given to these laws in the future. Especially should there be some legislation more definitely specifying the manner of presenting and verifying the accounts of this

branch of the public service.

We herewith accompany this report with the testimony taken by your committee. (See report No. 2023, H. of R., Forty-ninth Congress, first session; also Mis. Doc. 255, H. of R., Forty-ninth Congress, first session.)

On March 18, 1886, the following letter was sent to the Secretary of War:

SIGNAL OFFICE, WAR DEPARTMENT, Washington City, March 18, 1886.

SIR: In order that there may be no misunderstanding of the scope of the appropriations which may be made for the support of this service for the fiscal year ending June 30, 1887, nor that anything shall be left to construction, I have the honor to transmit herewith statement showing the items covered by the estimates submitted by this office under the titles "Expenses Signal Service, United States Army," "Observation and report of storms," and "Construction, maintenance, and repair of military telegraph lines," with the request that the same may be forwarded to the honorable the Speaker of the House of Representatives, for use of the Committee on Appropriations.

In regard to the estimates for salaries, stationery, contingent expenses, rents, postage, printing and binding, pay, subsistence, regular supplies, incidental expenses, transportation, barracks and quarters, clothing, camp and garrison equipage, medical department, and ordnance stores, I would say that the language of the estimates and the notes accompanying the same fully explain their scope. I also submit herewith a list of sta-

tions covered by the estimates for fuel under the regular supplies.

I am, very respectfully, your obedient servant,

W. B. HAZEN,

Brig. and Bot. Maj. Gen'l, Chief Signal Officer, U. S. Army.
The SECRETARY OF WAR.

Statement showing the items covered by the estimates submitted by the Signal Office for appropriations for the fiscal year ending June 30, 1887.

Estimates of appropriations required for the service of the fiscal year ending June 30, 1887.

OFFICE OF THE CHIEF SIGNAL OFFICER.

[Signal Service, page 93, Ex. Doc. No. 5, H. R., Forty-ninth Congress, first session.]

Expenses of the Signal Service of the Army, as follows:

Purchase, equipment, and repair of field electric telegraph: This covers the purchase of wire wagons, lance trucks, and battery wagons; wire, lances, battery, and line material and supplies, telegraph instruments and apparatus, crow-bars, digging-bars; repairs to wire wagons, repairs to lance trucks, repairs to battery wagons, tools for repairs, materials for repairs, &c.

Signal equipments and stores: This covers the purchase of cans, canteens and straps, canvas cases and straps, india-rubber cases, compasses (magnetic), funnels, flags (signal), haversacks, lanterns, scissors, flying-flame shades, foot-flame shades, flying extinguishers, foot extinguishers, jointed staffs, straps, flying torches, foot torches, tweezers, wormers, homographic disks, oil, turpentine, wicking, matches, wands, flambeaux, asbestos, packing, brass castings, brass tubing, and for the expenses (such as cages, bracelets, feed, &c.) of maintaining the carrier pigeons belonging to this service and used in experimental field communications, tools for manufacture and repair of equipments, &c. Binocular (or marine) glasses: This covers the purchase and repair of the marine

glasses, purchase of material for repairs, &c. Telescopes: This covers the purchase and repair of telescopes, purchase of material for

repairs, &c.

Heliotropes: This covers the purchase and repair of heliotropes, heliographs, heliotelegraph instruments, including all necessary material for repairs, such as mirrors,

pouches, brass, &c.

Other requisite instruments, including absolutely necessary meteorological instruments for use on target ranges: This covers the purchase of telegraph instruments, such as keys, sounders, relays, arresters, &c., and anemometers, wind-vanes, &c.

Telephone apparatus, and maintenance of same at military posts: This covers the purchase or rental of telephones and transmitters; the purchase of call-boxes; the purchase of battery supplies and material; the purchase of material for repairs to telephones,

transmitters, and call-boxes, &c.

Tolls over Aqueduct Bridge: This covers the use of the Aqueduct Bridge for the suspension and permanent location thereon of the telegraph wires forming the Signal Service lines between the office of the Chief Signal Officer and the post at Fort Myer, Virginia. Tolls payable to the Alexandria Canal, Railroad and Bridge Company, under an agreement amounting to \$500 per annum.

Estimates of appropriations required for the service of the fiscal year ending June 30, 1887, under the War Department, Signal Service.

Observation and report of storms: Expenses of meteorological observations and reports by telegraph, signal or otherwise, announcing the probable approach and force of storms, for the benefit of the commerce and agriculture of the United States (pp. 214-217, Ex.

Doc. No. 5, H. R., Forty-ninth Congress, first session).

Manufacture, purchase, and repair of meteorological instruments and expenses (moving, &c.) in connection therewith: This covers the manufacture or purchase of anemometers, anemescopes, barometers, aneroid barometers, blow-pipes, bottles, meteorologicaltool boxes, whirling apparatus, porcelain cups, files, forceps, funnels, screw-drivers, scissors, bellows, hygrometer boards, eye-glasses and cases, regulator clocks, alarm-clocks, marine clocks, compasses, hygrometer cups, quicksand cylinders, cord for water thermometers, faucets, gauntlets, rain-gauges, snow-gauges, gimlets, sand-glasses, greasers, artists' leads, mercury, oilers, clock-oil, telescopic anemometer rods, anemometer supports, retorts, self-registers for anemometers, self-registers for anemometers and anemescopes, raingauge supports, spatulas, exposed thermometers, maxium thermometers, minimum thermometers, hygrometer thermometers, water thermometers, cases for water thermometers, tin thermometer testers, barometer tubes, test-tubes, photographic apparatus and supplies, &c., all necessary tools and materials for repairs of instruments, labor and material and expenses of erecting and putting instruments in place at stations where they are to be used; expenses of moving and handling instruments, chemicals, ice, &c., for testing instruments, cotton, cloth and boxes for packing and shipping instruments, expenses of experiment and study in connection with instruments, including the expenses of maintaining a physical laboratory, at the office of the Chief Signal Officer.

Telegraphing reports, messages, and other information in connection with the observa-tion and report of storms, &c.: This covers telegrams in cipher at rates fixed by the Chief Signal Officer, as allowed by the Postmaster-General's circulars, sent from any station of this service, taking meteorological observations or received thereat (Washington, D. C., being such a station); special messages relating directly and exclusively to the cipher reports, although themselves not in cipher, sent from any station of this service, taking meteorological observations or received thereat; messages on the administrative affairs of the service—that is, regarding the duties of the enlisted men and civilian employes of the service, on stations where the exigencies of the service requires this mode of communication. In fact, this estimate is intended to cover the expense of any and all charges for telegraphing or telephoning necessary in carrying out efficiently all the appropriations of this service, and including river reports, cautionary displays, cold-wave reports, flood reports, cotton-region reports, hurricane reports, &c., where

such information has to be telegraphed, &c. The accounts to be settled and adjusted by the disbursing officer of the Signal Service.

Maintaining telegraph stations at Jacksonville, and mouth of Saint John's River, Florida: This covers the rent of a telegraph office at Jacksonville, Fla., needed in the

relaying of weather reports in that vicinity.

Telephones, and maintenance of same in offices maintained for public use in cities and places receiving reports outside of Washington, D. C., including exchange service in the office of the Chief Signal Officer of the Army: This covers the purchase or rental of telephones or exchange service in the principal cities, where stations of observation are

located, as well as similar service in the city of Washington.

Expenses of storm, cautionary, off-shore, cold-wave, railway-train, and other signals on the sea, lake, and Gulf coasts of the United States and the interior, announcing the probable approach and force of storms, including pay of observers, services of operators, lanterns, flags, &c.: This covers the pay of cautionary observers (or displaymen) and operators at the following or such other stations as may be deemed necessary by the Secretary of War: Ahnapce, Wis.; Ashtabula, Ohio; Bass River Light, Mass.; Bath, Me.; Bay City, Mich.; Booth Bay, Me.; Bristol, R. I.; Brunswick, Ga.; Cape Vincent, N. Y.; Charlevoix, Mich.; Charlotte, N. Y.; Cheboygan, Mich.; Monroe, Fort, Va.; Montague, Mich.; Morgan, Fort, Ala.; Muskegon, Mich.; New Bedford, Mass.; Newburyport, Mass.; New Haven Light, Conn.; Newport, R. I.; North Fair Haven, N. Y.; Northport, Mich.; Petoskey, Mich.; Pentwater, Mich.; City Island, N. Y.; Corpus Christi, Tex.; Dunkirk, N. Y.; East Tawas, Mich.; Elk Rapids, Mich.; Fall River, Mass.; Fernandina, Fla.; Fort George Island, Fla.; Frankfort, Mich.; Gloncester, Mass.; Green Bay, Wis.; Highland Light, Mass.; Hyannis, Mass.; Kenosha, Wis.; Kewaunee, Wis.; Ludington, Mich.; Manistee, Mich.; Manitowoc, Wis.; Marblehead, Mass.; Menominee, Mich.; Point Judith, R. I.; Port Eads, I.a.; Port Royal, S. C.; Portsmouth, N. H.; Provincetown, Mass.; Racine, Wis.; Rockland, Me.; Saint Augustine, Fla.; Saint Joseph, Mich.; Sand Beach, Mich.; Sand Key Light, Florida; Sheboygan, Wis.; Southeast Light, R. I. (Block Island); South Haven, Mich.; Tybee Island, Ga.; Wood's Holl, Mass.; station on Martha's Vineyard Island; station on Nantucket Island. The purchase of international code signal books, Piddington's horn books, maritime registers, nautical gazettes, cautionary-signal boards, Oil, oil-cans, Coston lights, cautionary flags, off-shore flags, direction flags, international flags, tin flag-symbols, halliards, cautionary signal indicators, lanterns, signal-lamps, flag-staffs, washing and repairing flags, tof-shore flags, int

Continuing the connection of signal stations with life-saving stations and light-houses (such connections being considered necessary as per opinions expressed by the Superintendent of the Life-Saving Service and the Chairman of the Light-House Board), including services of operators, repairmen, materials (such as cable, wire, poles, insulators, &c.), and general service, being for the maintenance and repair of the military telegraph line along the Atlantic coast of the United States. This covers the services of operators, repairmen, and other general service at the following or such other stations as may be deemed necessary by the Secretary of War: Atlantic City, N. J.; Barnegat City, N. J.; Block Island, R. I.; Cape Henry, Va.; Chincoteague, Va.; Hatteras, N. C.; Kitty Hawk, N. C.; Little Egg Harbor, N. J.; Cape Henlopen, Del.; Cape May Point, N. J.; Wash Woods, N. C.; Macon, Fort, N. C.; station on Martha's Vineyard Island; station on Nantucket Island; Narragansett Pier, R. I.; New River Inlet, N. C.; Norfolk, Va.; Ocean City, Md.; Point Judith, R. I.; Smithville, N. C.; Wilmington, N. C. The purchase of cable, wire, poles, insulators, brackets, plugs, cross-arms, nails, telegraph instruments, saddle-bags, boats, bridles, boat-chains, stable-forks and utensils, flags, (special life-saving), halters, harness, carts (repair), wreck-knapsacks, rent or purchase of telephones, transmitters, and call-boxes, spikes, pikes, wire reels, riding-saddles, pack-saddles, spurs, skiffs, oars, boatsails, surcingles, soldering tools, vises, subscription to maritime registers and nautical gazettes, and, in cases of emergency, the payment for the transportation of materials from points to points on the sea-coast line where the delay in securing transportation through the Quartermaster's Department would be disastrous to the service, and where it will be impossible to secure other transportation than that fornished by the natives by rowboat, team, or buck-board; the hire of teams, boats, animals, and other means of conveyance an

crossing inlets, and other costs of short transits to repair the line.

Manufacture, purchase, and repair of instrument-shelters, and expenses in connection therewith: This covers instrument-shelters, instrument-shelter supports, labor,

lumber, and nails, &c. For making same, expenses of erecting shelters and supports, and remains to shelters and supports, including remaining removing &c.

and repairs to shelters and supports, including re-painting, removing, &c.
Rents of offices, hire of civilian employés, furniture and other office supplies, light, heat (except coal and wood), heating-supplies, stationery, ice, repairs, rents of telephones, and for such other absolutely necessary expenses, not otherwise provided for, of offices maintained as stations of observation in cities or places outside of Washington, D. C. This coversall expenses of maintaining the following or such other stations as may be deemed necessary by the Secretary of War: Boston, Mass.; Chicago, Ill.; Cincinnati, Ohio; New York City, N. Y.; Abilene, Tex.; Albany, N. Y.; Alpena, Mich.; Atlanta, Ga.; Atlantic City, N. J.; Augusta, Ga.; Baltimore, Md.; Barnegat City, N. J.; Block Island, R. I.; Buffalo, N. Y.; Cairo, Ill.; Cape Henry, Va.; Cape Mendocino, Cal.; Cedar Keys, Fla.; Charleston, S. C.; Charlotte, N. C.; Chattanooga, Tenn.; Cheyenne, Wyo.; Chincoteague, Va.; Kitty Hawk, N. C.; Knoxville, Tenn.; La Crosse, Wis.; Lawer Mo.; Levenworth Kons.; Little Book, Ark.; Log Angeles, Col.; Lovisville, Kr. mar, Mo.; Leavenworth, Kans.; Little Rock, Ark.; Los Angeles, Cal.; Louisville, Ky.; Lynchburg, Va.; Philadelphia, Pa.; Saint Louis, Mo.; San Francisco, Cal.; Cleveland, Ohio; Columbus, Ohio; Concordia, Kans.; Davenport, Iowa; Denver, Colo.; Des Moines, Iowa; Detroit, Mich.; Eastport, Me.; El Paso, Tex.; Erie, Pa.; Escanaba, Mich.; Fort Smith, Ark.; Galveston, Tex.; Grand Haven, Mich.; Hatteras, N. C.; Huron, Dak.; Indianapolis, Ind.; Indianola, Tex.; Jacksonville, Fla.; Keokuk, Iowa; Key West, Fla.; Pittsburg, Pa.; Port Huron, Mich.; Portland, Me.; Portland, Oreg.; Red Bluff, Cal.; Rochester, N. Y.; Roseburg, Oreg.; Sacramento, Cal.; Mackinaw City, Mich.; Macon, Fort, N. C.; Marquette, Mich.; Memphis, Tenn.; Milwaukee, Wis.; Mobile, Ala.; Montgomery, Ala.; Moorhead, Minn.; Mount Washington, N. H.; Nashville, Tenn.; New London, Conn.; New Orleans, La.; Norfolk, Va.; North Platte, Nebr.; Olympia, Wash.; Omaha, Nebr.; Oswego, N. Y.; Palestine, Tex.; Pensacola, Fla.; Dubuque, Iowa; Boise City, Idaho; Frisco, Utah; Greencastle, Ind.; Keeler, Cal,; Deadwood, Dak.; Montrose, Colo.; Sitka, Alaska; Little Egg Harbor, N. J.; New River Inlet, N. C.: Wash Woods, N. C.; station on Nantucket Island; Saint Paul, Minn.; Saint Vincent, Minn.; Salt Lake City, Utah; San Diego, Cal.; Sandusky, Ohio; Sandy Hook, N. J.; San Luis Obispo, Cal.; Santa Fé, N. Mex.; Savannah, Ga.; Shreveport, La.; Smithville, N. C.; Springfield, Ill.; Toledo, Ohio; Valentine, Nebr.; Vicksburg, Miss.; West Las Animas, Colo.; Winnemucca, Nev.; Yankton, Dak.; Yuma, Ariz.; Colorado Springs, Colo.; Pike's Peak, Colo.; Sanford, Fla.; Wilmington, N. C.; New Haven, Conn.; Duluth, Minn.; San Antonio, Tex.; Cape Henlopen, Del.; Narragansett Pier, R. I.; Ocean City, Md.; station on Martha's Vineyard Island. To particularize the expenses, they are as follows: Rent of offices, where no accommodations are furnished in public buildings; the hire of civilian observers, assistant observers, messengers, janitors, and cleaners; the purchase of basins, bedsteads, blankets, brooms, brushes, buckets, bed-sacks, carpets, bookcases, office cases, pigeon-hole cases, chairs, water coolers, cups, table covers, cushions, desks, dippers, dusters, file cases, linoleum, lounges, mats or rugs, matting, mattresses, mirrors, maps, oil-cloth, dust-pans, pillows, pitchers, pots, bookracks, coat-racks, towel-racks, shades or curtains, office signs, spittoons, stands or tables, stools, towels, tubs, washstands, snow-shoes, moccasins, &c.; payment for gas, purchase of lamps, lanterns, oil, oil-cans, wicks, matches, lamp chimneys; repairs to lamps and lanterns; the purchase of stoves, pokers, coal-scuttles, fire-shovels, zincs for stoves, &c., repairs to stoves, &c.; payment for heating offices by steam, gas, or hot air; purchase of writing paper, envelopes, ink, mucilage, pens, pencils, blank-books, and other items of stationery; the purchase of ice, washing of towels, expenses in moving office, drinking water (when it cannot be obtained except by purchase); reimbursement to enlisted men for expenses incurred in making short transits in cities, in carrying out special instructions from this office, in connection with the meteorological service; repairs to offices where such repairs are necessary to fit the offices for the needs of this service, and repairs to buildings owned by this service; lumber, nails, and other material, and expenses for making packing boxes for shipment of supplies to stations of observation outside of Washington, D. C.; subscription to the American Meteorological Journal for issue to stations for use of observers; for necessary expenses in fitting up and maintaining stations of observations that may be established or re-established during the year, and for such other absolutely necessary expenses not specifically set forth, but necessary in the maintenance of the stations.

Expenses incident to the copying of synchronous international meteorological observations, to be used in connection with the publications of this office, and for observations in the West Indies, for special use in the announcement of hurricanes on the Atlantic and Gulf coasts of the United States. This covers the salaries of civilian observers in the West Indies at the following or such other stations as the Secretary of War may consider necessary: Havana, Cuba; Kingston, Jamaica; St. Thomas, St. Thomas; San Juan, Porto Rico; Santiago de Cuba, Cuba; Pointe a Pitre, Guadeloupe; Bridgetown, Barbadoes; St. Pierre, Martinique. The payment is for taking tri-daily meteoro-

logical observations, for telegraphing them, for forwarding mail reports, and for telegraphing hurricane information; payment for services rendered in collecting and copying reports of meteorological observations made on board of vessels of foreign nations for

use in the publications of the international bulletin.

River and flood observations and expenses incidental thereto: This covers the pay of the river observers at the following or such other stations as the Secretary of War may deem necessary: Albany, Oreg.; Alexandria, I.a.; Arkansas City, Ark.; Boonville, Mo.; Brookville, Pa.; Brunswick, Mo.; Brownsville, Pa.; Burnside, Ky.; Beardstown, Ill.; Bayon Sara, I.a.; Colusa, Cal.; Confluence, Pa.; Clarion, Pa.; Charleston, Tenn.; Clinton, Tenn.; Carthage, Tenn.; Coushatta Chute, I.a.; Camden, Ark.; Decatur, Ala.; Delhi, I.a.; Eugene City, Oreg.; Evansville, Ind.; Folsom City, Cal.; Freeport, Pa.; Fulton, Ark.; Harper's Ferry, W. Va. (during floods); Helena, Ark.; Hermann, Mo.; Gerard, I.a.; number reports, doubtful; Grand Tower, Ill.; Johnsonville, Tenn.; Johnstown, Pa.; Jerome, Mo.; Kansas City, Mo.; Kingston, Tenn.; Le Claire, Iowa; Loudon, Tenn.; Lendvale, Tenn.; Louisiana, Mo.; Lock No. 4, Pa.; Mahoning, Pa.; Marietta, Ohio; Marysville, Cal.; Monroe, I.a.; Mount Carmel, Ill.; Morgantown, W. Va.; Mount Holly, N. C.; New Geneva, Pa.; Newport, Ark.; Oil City, Pa.; Oroville, Cal.; Paducah, Ky.; Peoria, Ill.; Plattsmouth, Nebr.; Parker's Landing, Pa.; Rowlesburg, W. Va.; Rockwood, Tenn.; Saint Joseph, Mo.; Saltsburg, Pa.; Strawberry Plains, Tenn.; Umatilla, Oreg.; Vincennes, Ind. (special observations); Warsaw, Ill.; Wheeling, W. Va.; Warren, Pa.; Weston, W. Va.; Wabasha, Minn.; West Melville, I.a.; Yazoo City, Miss. The employment of a civilian clerk outside of Washington, D. C., having charge, under orders from this office, of the erection and repair of river gauges and instructing the observers (in regard to their duties) at the various river stations of the service. The manufacture, purchase, construction, erection, and repair of river gauges, and the manufacture, purchase, and repair of rain gauges, and the wind-vanes used in the special work, including all labor, tools, and materials for the same, and for such other proper expenses necessary to maintain this branch of the service.

Expenses (including paper, forms, printing supplies, hire of civilian printers, engravers, &c.) of preparing, printing, and distributing maps and bulletins to be displayed in chambers of commerce and boards of trade rooms and for distribution; also for "professional papers," "Signal Service notes," and for the maintenance of a printing office under the direction of the Chief Signal Officer, in the city of Washington, for the printing of the necessary orders, circulars, maps, bulletins, &c., as may be necessary to carry into effect the appropriations made for the support of the Signal Service: This covers paper for printing at the office of the Chief Signal Officer, and for such other printing stations as the Secretary of Warmay deem necessary; the purchase of press-blankets, bellows, bed-plates, benzine, bodkins, miter boxes, oil cans, printing cases, type cases, chases, paper-cutter, presses, cyclostyles and appurtenances, printing-press covers, dies, matrices, type symbols, electrotypes, stereotypes, bulletin frames, map frames, monthly mean frames, printing frames, type furniture, galleys, hektographs and supplies for same; printing ink, leads, lye, mallets, paint mills, boilers, engines, oil, planers, printing presses, punches, quoins, damping rollers, ink-rollers, proof presses, rule, composing rules, imposing stand, type-stands, printing sticks, shooting sticks, styli, spatulas, tin (sheetsof), tweezers, twine, type, turpentine, tallow, lithograph presses, lithograph stone, lithograph ink, and such other supplies and material necessary; the hire of civilian printers at such stations where in the opinion of the Secretary of War their services may be necessary; the purchase of large wall maps and symbols for display, the purchase of manifold forms, carbon paper, and expenses of preparing and issuing the forms, the manifold forms, earlier paper, and expenses of preparing and issuing the forms, the services of engravers and the engraving of maps, charts, &c.; the distribution of publications through the Smithsonian Institution; wrappers for bulletins; the preparing, printing, and publishing of "professional papers," "Signal Service notes," weather reviews, &c., and for the maintenance of a printing office under the direction of the Secretary of War, in the city of Washington, for the printing of the necessary orders, circulars, schedules, forms, maps, bulletins, &c., as may be necessary to carry into effect the appropriations for the support of the Signal Service.

Observations and expenses incidental thereto announcing the probable approach and severity of frosts for the benefit of the cotton region of the United States: This covers: the pay of observers, operators, and messengers in taking, sending, receiving, relaying, &c., cotton region reports at the following or such other stations as the Secretary of War may deem necessary: Aberdeen, Miss.; Albany, Ga.; Alexandria, La.; Allapaha, Ga.; Allendale, S. C.; Amite City, La.; Anderson, S. C.; Arkansas City, Ark.; Athens, Ga.; Austin, Tex.; Brenham, Tex.; Bainbridge, Ga.; Batesburg, S. C.; Batesville, Miss.; Beaumont, Tex.; Belton, Tex.; Birmingham, Ala.; Blackville, S. C.; Bolivar, Tenn.; Branchville, S. C.; Calera, Ala.; Cammack, Ga.; Cartersville, Ga.; Cheneyville, La.; Cheraw, S. C.; Chester, S. C.; Columbia, S. C.; Columbia, Tex.; Brinkley, Ark.; Brookhaven, Miss.; Brownsville, Tenn.; Columbus, Ga.; Columbus, Miss.; Corinth, Miss.;

Corsicana, Tex.; Conshatta Chute, I.a.; Covington, Tenn.; Cuero, Tex.; Dallas, Tex.; Dalton, Tex.; Decatur, Ala.; Devall's Bluff, Ark.; Dyersburg, Tenn.; Eastman, Ga.; Edwards, Miss.; Eufaula, Ala.; Evergreen, Ala.; Fernandina, Fla.; Florence, S. C.; Fort Deposit, Ala.; Fort Gaines, Ga.; Gainesville, Ga.; Goldsborough, N. C.; Grand Junction, Tenn.; Greenville, S. C.; Greenville, Ala.; Greenwood, S. C.; Grenada, Miss.; Griffin, Ga.; Hardeeville, S. C.; Hazlehurst, Miss.; Hearne, Tex.; Helena, Ark.; Hempstead, Tex.; Hernando, Miss.; Holly Springs, Miss.; Houston, Tex.; Huntsville, Tex.; Jackson, Miss.; Jacksonborough, S. C.; Jessup, Ga.; Kensett, Ark.; Kingstree, S. C.; La Fayette, La.; Lake, Miss.; Live Oak, Fla.; Livingston, Ala.; Longview, Tex.; Luling, Tex.; Lumberton, N. C.; Macon, Ga.; Macon, Miss.; Madison., Ark.; Magnolia, Ark.; Malvern, Ark.; Marion, Ala.; Meridian, Miss.; Milan, Tenn.; Millen, Ga.; Minden, La.; Monroe, La.; Monticello, Ark.; Natchez, Miss.; Natchitoches, La.; New Berne, N. C.; Newport, Ark.; Okolona, Miss.; Opelika, Ala.; Opelousas, La.; Orange, Tex.; Oxford, Miss.; Paris, Tex.; Paris, Tenn.; Pine Apple, Ala.; Pine Bluff, Ark.; Fort Gibson, Miss.; Prescott, Ark.; Quitman, Ga.; Raleigh, N. C.; Russellville, Ark.; Saint George's, S. C.; Saint Matthew's, S. C.; Salisbury, N. C.; Scottsborough, Ala.; Selma, Ala.; Simthville, Ga.; Sour Lake, Tex.; Spartanburg, S. C.; Texarkana, Ark.; Thomasville, Ga.; Toccoa, Ga.; Tuscumbia, Ala.; Tyler, Tex.; Union Point, Ga.; Waco, Tex.; Waldo, Fla.; Wadesborough, N. C.; Washington, Ga.; Way Cross, Ga.; Withe, Tenn.; Waynesborough, Ga.; Waynesborough, Miss.; Weatherford, Tex.; Weimar, Tex.; Weldon, N. C.; West Point, Ga.; Whiteville, La.; Yemassee, S. C. The purchase of thermometers and rain-gauges and repairs to the same; the purchase of instrument shelters and repairs to the same, and for such other incidental expenses as may be necessary.

Expenses of collection and collation of meteorological observations made by ship-masters and ship captains, for the more complete study of storms, with a view to the accurate prediction of their frequency, periodicity, and direction: This covers subscription to Maritime Registers and Nautical Gazettes for issue to ship captains in return for observations furnished, and other expenses of marine agencies at New York, Boston, Philadelphia, Baltimore, and San Francisco, or at such other places as in the opinion of the

Secretary of War such agencies may be necessary.

Expenses incident to the instruction department at the post of Fort Myer, Va., including text-books, stationery, furniture, &c.: This covers stationery, telegraph instruments, and supplies, text-books, furniture, and such other articles or expenses necessary to maintain and continue the work of this department of the Bureau.

For incidental expenses not otherwise provided for: This covers such items of legitimate expenses which cannot now be anticipated and thus specifically provided for.

Library and other books, periodicals, and newspapers: This covers necessary books of reference in prosecuting the study of the science of meteorology, as well as text-books for issue to stations of observation, such as Buchan's Hand-Book of Meteorology, Culley's Telegraphy, Guyot's Meteorological Tables, Loomis's Meteorology, Pope's Telegraphy, Prescott's Electricity, &c. Also, subscription to scientific periodicals and newspapers.

Manuscript and card catalogues: This covers the purchase of original manuscripts on meteorological subjects from the authors of the same, as well as expenses in preparing

card catalogues of meteorological bibliography.

Lumber: This covers lumber of all grades and kinds for the purpose of making packing-boxes for shipment of material and supplies to stations outside of Washington,

Advertising: This covers the cost of advertising notices inviting proposals for furnish-

ing supplies, &c., and for sales of condemned property.

Erection of a new observatory on Mount Washington, N. H.: This is to provide for the better protection of the men and material at the station of Mount Washington, N. H., a very important station of this service, yet in winter isolated from the world, and in order to obtain the best results for the Signal Bureau.

Estimates of appropriation required for the service of the fiscal year ending June 30, 1887, under the War Department, Signal Service.

Construction, maintenance, and repair of military telegraph lines. (P. 217, Ex. Doc.

No. 5, Forty-ninth Congress, first session.)

Construction of military telegraph line for the connection of military posts as follows: Fort Gaston, Cal., to North Fork Mad River, Cal., 30 miles; Fort Halleck, Nev., to Halleck Station, Nev., 12 miles, including instruments, materials, and extra-duty pay to troops. This covers the purchase of wire, poles, insulators, brackets, telegraph instruments, battery material, and supplies, &c., and the extra-duty pay to be paid to

the enlisted men detailed to build the lines, and the hire of teams, wagons, tools, &c., in connection with the building of said lines.

Maintenance and repair of military telegraph lines, including rents of offices, salaries of civilian operators and repairmen, lights, supplies, and general repairs: This covers the expenses of maintaining the following or such other stations as may be deemed necessary by the Secretary of War: Astoria, Oreg.; Ashland, Oreg.; Apache, Fort, Ariz.; Assinaboine, Fort, Mont.; Ash Fork, Ariz.; Bismarck, Dak.; Bridger, Fort, Wyo.; Irownsville, Tex.; Buford, Fort, Dak.; Benton, Fort, Mont.; Bidwelle, Fort, Cal.; Benton, Et, Fort, Dak.; Bowie, Fort, Ariz.; Canby, Fort, Wash.; Custer, Fort, Mont.; Cantonment, Ind. T.; Carter, Wyo.; Custer Station, Mont.; Coeur d'Alene, Idaho; Dodge City, Kans.; Dayton, Wash.; Davis, Fort, Tex.; Durango, Colo.; Elliott, Fort, Tex.; Edinburg, Tex.; Glendive, Mont.; Galpin, Mont.; Grant, Fort, Mont.; Helena Mont.; Henrietta, Tex.; Klamath, Fort, Oreg.; Lewiston, Idaho; Lakeview, Oreg.; Laramie, Fort, Wyo.; Linkville, Oreg.; Lava, N. Mex.; Lacota, Dak.; Larimore, Dak.; Maginnis, Fort, Mont.; Maricopa, Ariz.; McDowell, Fort, Ariz.; María, Tex.; Neah Bay, Wash.; Pysht, Wash.; Poplar River, Mont.; Port Angeles, Wash.; Phœnix, Ariz.; Parker's, Oreg.; Rio Grande City, Tex.; Reno, Fort, Ind. T.; Robinson, Fort, Nebr.; Shaw, Fort, Mont.; Spokane Falls, Wash.; Stanton, Fort, N. Mex.; Stockton, Fort, Tex.; San Carlos Agency, Ariz.; Spokane, Fort, Wash.; Supply, Fort, Ind. T.; Santa Maria, Tex.; Sulty, Fort, Dak.; Sill, Fort, Ind. T.; Tatoosh Island, Wash.; Totten, Fort, Dak.; Thomas, Fort, Ariz.; Tucson, Ariz.; Verde, Fort, Ariz.; Watrous, N. Mex.; Webster, Dak.; Wickenburg, Ariz.; Willcox, Ariz.; Yates, Fort, Dak. These expenses are for rents of ofices, the hire of civilian operators, repairmen, and messengers; the purchase of lamps, lanterns, matches, oil, wicks, lamp-chimneys; the payment forgas; purchase of lamps, lanterns, matches, oil, wicks, lamp-chimneys; the payment forgas; purchase of lamps, lanterns, melans, poles, plug-drivers, soldering furnaces, electric gongs, telegraph keys, sounders,

The other estimates made by this service for pay, subsistence, regular supplies, incidental expenses, transportation, barracks and quarters, clothing, camp and garrison equipage, medical department, ordnance stores, are fully explained in the language of

the estimates and notes accompanying the same.

Under the title "Signal Service, regular supplies, fuel, authorized allowance for enlisted men at Fort Myer, Va., and for various offices at Fort Myer, Va., and on United States military-telegraph lines, and at stations of observation outside of Washington. D. C., and for sales of the regulation allowance to officers of the Signal Corps, and those doing duty therewith (for fires the year round when needed):" It is intended that this estimate shall provide fuel for the following-named stations or such others as the Secretary of War may deem necessary: Atlantic City, N. J.; Alpena, Mich.; Abilene, Tex.; Augusta, Ga.; Baltimore, Md.; Boisó City, Idaho; Block Island, R. I.; Chattanooga, Tenn.; Cape Henry, Va.; Cape Henlopen, Del.; Cape Mendocino, Cal.; Charleston, S. C.; Charlotte, N. C.; Cedar Keys, Fla.; Chicago, Ill.; Chincoteague, Va.; Concordia, Kans.; Colorado Springs, Colo.; Deadwood, Dak.; Des Moines, Iowa; Dubuque, Iowa; Eastport, Maine; Escanaba, Mich.; El Paso, Tex.; Erie, Pa.; Frisco, Utah; Fort Smith, Ark.; Galveston, Tex.; Greencastle, Ind.; Hatteras, N. C.; Huron. Dak.; Indianola, Tex.; Jacksonville, Fla.; Keeler, Cal.; Keokuk, Iowa; Key West, Fla.; Kitty Hawk, N. C.; Lamar, Mo.; La Crosse, Wis.; Leavenworth, Kans.; Little Rock, Ark.; Iogansport, Ind.; Los Angeles, Cal.; Lynchburg, Va.; Marquette, Mich.; Mackinaw City, Mich.; Macon, Fort, N. C.; Memphis, Tenn.; Milwaukee, Wis.; Mobile, Ala.; Montgomery, Ala.; Moorhead, Minn.; Montrose, Colo.; Mount Washington, N. H.; Narragansett Pier, R. I.; Nashville, Tenn.; New London, Conn.; New River Inlet, N. C.; Norfolk, Va.; Ocean City, Md.; Omaha, Nebr.; Oswego, N. Y.; Olympia, Wash.; Pensacola, Fla.; Pike's Peak, Colo.; Portland, Oreg.; Port Huron, Mich.; Red Bluff, Cal.; Roseburg, Oreg.; Savannah, Ga.; Salt Lake City, Utah; Sacramento, Cal.; San Francisco and branch, Cal.; Santa Fé, N. Mex.; Saint Paul, Minn.; Saint Vincent, Minn.; San Diego, Cal.; San Luis Obispo, Cal.; Sanford, Fla.; Sandy Hook, N. J.; Shreveport. La.; Sitka, Alaska; Smithville, N. C.; V

Telegraph Offices—Apache, Fort, Ariz.; Assinaboine, Mont.; Ashland, Oreg.; Astoria, Oreg.; Bismarck, Dak.; Brownsville, Tex.; Bridger, Fort, Wyo.; Buford, Fort, Dak.; Bidwell, Fort, Cal.; Cantonment, Ind. T.; Cœur d'Alene, Fort, Idaho; Custer, Fort, Mont.; Canby, Fort, Wash.; Dodge City, Kans.; Davis, Fort, Tex.; Elliott, Fort, Tex.; Helena, Mont.; Klamath, Fort, Oreg.; Lakeview, Oreg.; Lava, N. Mex.; Lewiston, Idaho; Linkville, Oreg.; Maricopa, Ariz.; Maginnis, Fort, Mont.; McDowell, Fort, Mont.; Myer, Fort, Va.; Neah Bay, Wash.; Prescott, Ariz.; Phœnix, Ariz.; Port Angeles, Wash.; Poplar River, Mont.; Pysht, Wash.; Reno, Fort, Ind. T.; Rio Grande City, Tex.; Robinson, Fort, Neb.; San Carlos, Ariz.; Stanton, Fort, N. Mex.; Sully, Fort, Dak.; Sill, Fort, Ind. T.; Spokane Falls, Wash.; Stockton, Fort, Tex.; San Antonio, Tex.; Tatoosh Island, Wash.; Thomas, Fort, Ariz.; Totten, Fort, Ariz.; Wickenburg, Ariz.; Willcox, Ariz.; Yates, Fort, Dak.

(See Ex. Doc. No. 175, H. of R., Forty-ninth Congress, first session.)

#### PROPERTY RESPONSIBILITY.

In regard to my responsibility for the property belonging to this service, I would say that under the present rules each article purchased is taken up on the property report which is rendered quarterly to the Chief Signal Officer, for transmission to the Third Auditor of the Treasury, so that not one article, from the merest trifle to the most expensive, but what is carefully reported every three months to the accounting officers of the Treasury. And when it is considered that the property is scattered all over the United States at all of the stations of this service, and that frequent inventories have demonstrated the absolute accuracy of my reports, the vast amount of care required to produce such a result can be more readily appreciated.

Whenever articles for the use of the Government are ordered and received at this office I have in each case personally examined the same, so far as their receipt at this office was concerned, and have had the articles inspected by a competent person before their accept-

ance.

#### STORE-HOUSE.

There is always an accumulation at this office of valuable Government property, and I would invite the attention of the Chief Signal Officer to the very inadequate store-house, and recommend that, if possible, some action may be taken to furnish storage room of a better character and greater capacity.

#### FIRE-PROOF BUILDING.

It would seem that while several estimates have been submitted for a fire-proof building, they have been thus far ignored, and the accumulation of the work of this service and the result of the observations made, together with the valuable property, is worth protection. Congress should be urged to favorably consider the estimate submitted for a fire-proof building adapted to the needs of this service.

#### STATUS OF WORK.

The work of the division is well up to date, and all possible provision has been made to continue the service for the next fiscal year on the same basis as during the past fiscal year. Leases have been renewed (subject, of course, to an appropriation) and proposals have been invited and received for the year's supplies at this office, as well as at stations, as needed. Of course no authorities can issue looking to incurring any expense until Congress shall have passed the appropriations for which estimates have been

I would invite attention to the fact that when I entered upon the duties of property and disbursing officer, one year ago, I was not at all familiar with the duties of that office, but had to rely in a great measure upon the knowledge of the chief clerk of the division, Mr. W. R. Bushby, and I take great pleasure in stating that the efficient service rendered by him has been of inestimable assistance to me in transacting the business of the division.

I would also state that with but few exceptions the men on duty in the division have well and faithfully performed the duties assigned them.

I am, very respectfully, your obedient servant,

FRANCIS B. JONES, Captain and Assistant Quartermaster, U. S. A., Property and Disbursing Officer, Signal Service.

The CHIEF SIGNAL OFFICER OF THE ARMY.

## APPENDIX 15.

#### ANNUAL REPORT OF THE EXAMINING OFFICER.

SIR: The work of this division has been conducted with the same regularity and form s in the preceding years. No new rules or methods have been introduced. now as in the past relate wholly to the preservation of the fiscal integrity of the service. So far as lies within my power, no purchases or engagements are made that are not necessary, economical, and lawful, and no disbursements are made that come under my supervision that are not in strict accordance with previous authority or approval.

As is but natural, cases occasionally arise where authority for expenditure of money is requested in which the request does not coincide with my views upon the subject. These cases are fully investigated and a satisfactory understanding is arrived at before the issuance of the authority, or else, failing such understanding, the matter is referred for the personal decision of the Chief Signal Officer. Such cases are fortunately rare.

This division, originally instituted for the purpose of assuring a rigid honesty in the monetary affairs of the service, after an exposé of unparalleled thievery and looseness of management, itself in a great measure culpable, has, happily, because of the sometimes painfully solicitous honest management of the application and disbursement of the public funds, reached a time when the corrections to be made and errors to be guarded against are those that are purely technical in their nature.

Were we sure that in the future there would be the same rigid honesty on the part of all officers whose duties lie near to the appropriations for the support of this service, this division might well be abolished and the purely clerical labor of examining property returns of signal property throughout the country confided to a branch of the property division. But the millennium has not yetarrived; indeed, is hardly due, judging from recent matters connected with this service, and none are infallible but ourselves.

It seems to me at times that, for the small amounts of signal property in the hands of very many officers, the amount of reports and the labor of examination are greatly in excess of the value of the articles reported.

When it is considered that these reports require the preparation, examination here, the notification of the responsible officer, frequent but necessary correction of insignificant errors, the transmittal with a separate letter for each account to the Third Auditor and their examination there, and that this happens four times in each year, and that these reports must necessarily cover only property small in quantity and value, it is worthy of serious thought whether or not a report of signal property made once in each year, or at most once in each half year, would not be all-sufficient.

I must call attention to the deplorable sanitary condition of the rooms occupied by this division; the working room in which three clerks are daily confined is small and dark, cold in winter and warm in summer. Such quarters surely shorten their lives. My own room is little better, and to add to the situation there is an ever-present stale, illsmelling odor, rising at frequent times to a pitch that is all but visible. I am aware that these are the best rooms the service can afford, and that they are much better than

many others.

The office force, with myself, have worked steadily, faithfully, and diligently, and in these days of threatened disaster and insidious attack can but look forward into the future, wondering and fearing.

A summarized report of the work performed in the division has been already sub-

mitted, and should be filed with this report as a part thereof.

I am, very respectfully, your obedient servant,

FRANK GREENE, Second Lieutenant, Signal Corps, U. S. Army, In charge of the Examiner's Division.

The CHIEF SIGNAL OFFICER OF THE ARMY.

Summary of work performed in Examiner's Division, Office of the Chief Signal Officer, during the fiscal year ending June 30, 1886.

[Name of officer in charge—Second Lieut, Frank Greene, Signal Corps, U. S. Army.]

Date.	Returns of Signal equipments and stores examined and for- warded to the U. S. Treasury.	Letters sent in connection with the examination of money accounts and property returns.	Letters received and recorded.	Letters of authority for pur- chases and expenditures re- ceived, examined, and re- corded.	Purchase vouchers audited and recorded.	Expenditure vouchers audited and recorded.	Accounts current, line receipts, examined and forwarded to the U. S. Treasury.	Weekly and monthly state- ments of public funds re- corded and verified.	Accounts current of the Property and Disbursing Officer, Signal Service, U. S. Army, audited and forwarded to U. S. Treasury.	Accounts current, sales at auction, audited and forwarded to U. S. Treasury.
July, 1885 Aug., 1885 Sept., 1885 Oct., 1885 Nov., 1885 Dec., 1885 Jan., 1886 Feb., 1886 Mar., 1886 April, 1880 May, 1886 June, 1886	61 83 45 19 82 82 109 77 110 88 129 31	301 554 121 54 225 222 260 205 260 209 307 81	438 114 106 240 138 119 255 90 112 246 110	419 308 247 287 197 264 291 105 158 179 199	106 97 149 130 95 144 124 66 200 80 122 158	472 548 582 794 347 884 579 335 449 426 456 417	5 0 0 10 9 3 3 0 5 10	10 12 8 6 15 13 13 9 16 9	03000000000000000000000000000000000000	0 0 0 2 2 0 0 0
	*916	2,799	2,086	2,857	1,477	5,759	<b>*</b> 55	140	*13	2

^{*}These figures do not, however, represent the actual number of papers handled, as in nearly every instance the accounts and returns are accompanied by numbers of vouchers and subvouchers, varying from one or two to several hundred, as in the accounts of the Property and Disbursing Officer, which have varied from 600 to 800 each, which do not appear as a separate item in this summary.

#### APPENDIX 16.

#### ANNUAL REPORT OF THE OFFICER IN CHARGE OF THE PUBLICATIONS DIVISION.

PUBLICATIONS DIVISION, SIGNAL OFFICE, Washington, D. C., July 1, 1886.

SIR: I have the honor to herewith submit the report of work done in the Publications

Division during the fiscal year ending June 30, 1886:

The total number of employes in the division is 30, consisting of 22 enlisted men and 8 civilians, a reduction of 14 since my last report. This reduction of force was incident to the discontinuance of the publication of the Daily Bulletin of International Observations and of Professional Papers and Signal Service Notes, and was further necessitated by deficiency of appropriation. These employés are classified as follows: Cinef clerk, 1; clerks, 3; draughtsmen, 5; printers, 8; lithographers, 4; proof-reader, 1; pressmen, 3; press boy, 1; stitchers and folders, 2; engineer, 1; laborer, 1.

The division is divided into three subdivisions, known as the draughting room, printing room, and distributing room, each with a capable man in charge. The reports for the several subdivisions are given below:

#### DRAUGHTING ROOM.

The force in this subdivision consists of one sergeant in charge and four enlisted men as draughtsmen, and one enlisted clerk. The work of this subdivision, as shown below, shows a slight increase as compared with that of the year ending June 30, 1885. This increase of work is especially noted in the item of miscellaneous drawings.

Summary of work executed during fiscal year 1885-1886 in the draughting room, Publications Division.

Tri-daily and international monthly weather charts, reduced by pantograph	2, 060
Tri-daily, monthly weather review, and other miscellaneous drawings and charts	
transferred to stone	656
Forms transferred to stone	17
International daily charts, prepared for transfer	
Miscellaneous drawings and charts, completed	
Drawings and maps backed with cotton	13
Printed charts inspected	
	,

#### Charls prepared in international subdivision of draughting room.

International daily weather charts, completed	365
International monthly weather charts, completed	12
International annual weather charts, completed	1
Miscellaneous charts, completed	20
Monthly weather review charts, completed	40
Data for monthly weather review, sets	12

#### PRINTING ROOM.

The force in the printing subdivision consists of 1 sergeant in charge, 7 printers, 4 lithographers, 1 proof reader, 3 pressman, 1 press-boy, 2 stitchers and folders, 1 engineer and 1 laborer. This force is divided into 15 enlisted men and 6 civilians. With the exception of the items, Daily Bulletin of International Observations and Signal Service Notes and Professional Papers, the work of this subdivision has been quite materially increased, 28 will be seen by the tabulated statement below. This increase has taken place in spute of the decrease of force, and of the fact that no improvements have been made in the office facilities during the year. The presses and machinery are old and are in need of overhaul

ing, and, in some instances, of replacement by new and improved machinery. Especially is this true of the lithographic facilities, which have long been inadequate for the work required of them. There has been a steady improvement in the quality of the work done in this subdivision, which compares very favorably with work done in private printing and lithograph establishments. The following is a detailed statement of the work done during the past year:

Statement of printing and lithograph work performed during the year ending June 30, 1886.

	No. of copies.
Printing:	0.500
Daily bulletin of international observations	
Special bulletin and indications	
General orders	
Special orders	
Signal Service instructions	13,660
Signal Service circulars	43, 450
Professional Papers	1,500
Signal Service Notes	
Monthly Weather Review	
Monthly Summary and Review of International Meteorology	
Post-office wrappers	
Letter-heads.	
Letters	
Envelopes	
Forms	
Miscellaneous	127,479
Lithograph:	158 000
Base maps	
Morning maps, 7 a. m	126, 717
International charts, daily	35, 484
Monthly weather-review charts	218, 115
Monthly summary charts	6,744
Tri-daily meteorological record charts	206, 812
Letter-heads	29,560
Circulars	44, 490
Forms	
Miscellaneous	

#### DISTRIBUTING ROOM.

The work of this subdivision consists in distributing the publications of the Service to the regular recipients and in answering applications for publications from parties who are not regularly listed for their receipt. To secure an economical and proper distribution of the various publications of the Service to the large number of co-operators with the Service and parties entitled by exchange to the favor, requires a large amount of bookkeeping. This work has been simplified and very much lessened by the opening of a new set of books, referred to in my last report, in which the lists of regular and casual recipients are handled in the most systematic manner possible. The limited number of surplus copies remaining after the regular lists have been filled requires careful scrutiny of, and discrimination in, the applications received for them. These applications are growing rapidly in number, and great care is taken to save the stores from improper and valueless distribution. The issue of the periodical publications of the office, the daily weather map, the Monthly Weather Review, and the monthly summary, has been carried on with promptness and with little complaint. To this subdivision also belongs the work of storing and preserving the "reserve publications." During the past year these publications have been overhauled and rearranged, entailing a large amount of The work, however, was done at intervals, without interference with the current work of the division.

In conclusion, I am gratified to be able to say that I believe the division to be in better condition than at my last report as respects organization and efficiency.

F. B. JONES, Captain and Assistant Quartermaster, A. S. O., In charge Publications Division.

The CHIEF SIGNAL OFFICER OF THE ARMY.

## APPENDIX 17.

### ANNUAL REPORT OF THE OFFICER IN CHARGE OF THE METEOROLOGI-CAL RECORD DIVISION.

WASHINGTON, D. C., July 9, 1886.

SIE: In compliance with memorandum instructions lately received, I have the honor to transmit herewith a report, in duplicate, of work in the Meteorological Record Division for the year ending June 30, 1888.

Since March 4 the work has progressed very slowly, owing to a reduction of the clerical force from eleven to three. With the latter number the work has been carried on at much disadvantage. A clerical force of five is the minimum that can be employed to carry on the work without loss of time.

Very respectfully, your obedient servant,

JNO. P. FINLEY Second Lieutenant, Signal Corps, U. S. A.

CHIEF SIGNAL OFFICER OF THE ARMY. Washington, D. C.

Statement of work done in the Meteorological Record Division for the year ending June 30, 1886.

The work of the Meteorological Record Division, when completed in the printed form, sumes three distinct divisions:

The tabular statement of data for the different stations.
 The map prepared from the data in this table.
 The synopsis and indications made from the same data.

In bringing the work to this form the following steps are necessary: (1) Preparation from original records of manuscript for the table.

(2) Comparison of this table, when completed, with the originals.
(3) "Starring" or marking of stations from which reports were not received in time to be used in making the synopsis and indications.

(4) Entry upon charts of the data in the table.

- (5) Comparison of these charts with the data from which they are made.
  (6) The drawing of isobaric and isothermal lines and tracing the paths of storm centers on these charts, with a review of the same by some other officer than the one by whom they were drawn.
  - (7) The entry and comparison of synopses and indications made from the above data.

(8) Reading proof of the tabular statement and synopses and indications.

(9) Reading proofs (three) of maps.
(10) Preparation of Pacific slope maps for use of the officer in charge at San Francisco. This forms no part of the Meteorological Record, but has come to be a regular work in this division.

In the subjoined table the work performed is recorded under these different headings, the order of this statement being changed so that all of the different steps pertaining to each of the three ultimate divisions may appear as one group:

	MS. Record.				MS. Charts.								Synopses and indi- cations.			Pacific slope maps.	
Date.	Stations copied.	Stations com- pared.	Pages starred.	Pages of proof read.	Made.	Compared.	Lines drawn.	Lines reviewed.	First proofs read.	Second proofs read.	Third proofs read.	Entered.	Compared.	Written, but not compared.	Made.	Compared.	
July, 1885	97	57		59	50	53	57				<b> </b>		90		872	465	
Aug., 1885 Sept., 1885	2 53		183	96	15	12		· • • • • • • • • • • • • • • • • • • •	9			ļ. <b></b>	183		1,239	1,464	
Oct., 1885	90			108	347	230	12 142	•••••	57 118	120	33 52	10	10	******	1,185	462 813	
Nov., 1885		201	····	8	425	207	75	••••				10	10	*******	102	913	
Dec., 1885	32	178			333	56	30		38	36	46				360	360	
Dec., 1885 Jan., 1886	287				237	765	74		93	56	60			94			
Feb., 1886	768		ļ		!		81		62	72	52	ļ		152			
Mar., 1886	144	283				<b> </b> -	ļ. <b></b>	6	20	45	41	ļ		50		ļ	
Apr., 1886	j•••••	63 159		<u>'</u>	108 75	·····		•••••	····	4	8	·····	·····	14	183 93	···-	
May, 1886 June, 1886	13	163	1	16	93	·····		•••••			16	l			93	369	
June, 1000		100		10							10					305	
Totals	1, 396	1, 104	183	295	1,685	1,323	471	6	397	833	308	10	283	310	3,629	3, 933	

Note.—Old records were corrected as follows: Cairo, barometer for 19 months; Cincinnati, for 12 months; Indianapolis, 14 months; Fort Davis, 5 months; Los Angeles, 16 months; Louisville, 16 months; Rochester, 6 months; Saint Louis, 13 months; Saint Vincent, 10 months; and Yuma, 2 months. Two pages of January, 1882, record were recopied. The thermometer readings in the Uglaamie record were corrected to agree with the printed official report, and relative humidity substituted for the readings of the wet-bulb thermometer for the entire period during which the station had been maintained. Time equal to about two months' work for one person was given to examination and special report upon work already done and to the correction of such imperfections in the synopses and indications as could be done without reference to the original copies. A series of fourteen maps, January, 1836, 6th, 3 p. m. to 10th, 11 p. m., was made for the Indications' Division from the original records.

## APPENDIX 18.

## REPORT OF TORNADO WORK.

SIGNAL OFFICE, WAR DEPARTMENT, Washington City, July, 8, 1886.

SIR: In compliance with instructions lately received, I have the honor to forward herewith, in duplicate, a report on tornado work for the year ending June 30, 1886.

I am, very respectfully, your obedient servant,

JNO. P. FINLEY, Second Lieutenant, Signal Corps, U. S. A.

The CHIEF SIGNAL OFFICER, U. S. A., Washington, D. C.

List of voluntary tornado-reporting stations of the United States Signal Service, by States, for the fiscal year ending June 30, 1886.

Number of stations.	State.	Number of stations.
82	Mississippi	2
26		7
l i	Nebraska	
15	New Hampshire	_
1	New Jersey	
	New York	3
2	North Carolina	12
141		5
38	Pennsylvania	7
50		
1	South Carolina	11
83	Tennessee	3
131	Texas	G
85	Vermont	
10	Virginia	
5		
6	Wisconsin	10
23	1	
77	Grand total	1,56
	226 1 15 1 38 2 141 38 50 1 83 131 5 6	State   Stat

Statement of work performed in Tornado Division since April, 1882, when I assumed charge, to June 30, 1886.

Subject.	Prepared and published.	Sent.	Received.	Mado.	Stations opened.	Pages indexed.	Pages entered.	Supplied.	Months made.	Names listed.
Tornado circulars										
Professional papers										
Signal-Service notes	1									
Tornado predictions						•••••	•••••	•••••	-124	
Communications received			A' TTO				•••••	••••••	•••••	
Reports received on regular	!	!	0 000		,				1	
M and allowing made and	1		1 '	1	l .	i .	1		ı	********
Newspaper clippings made and placed in scrap-books	ŀ	ł	ł	ł		,	1 902			
Tornado abstracts for fact room							1,200		18	*******
Tornado-reporting stations		***************************************		*********	1.562		***********			********
Charts of temperature and wind	· · · · · · · · · · · · · · · · · · ·				1,000					*********
directions, prepared for days	ì	l	1	l	i					
on which tornadoes occurred	.		J	105					<u></u>	
Letters sent										
Indexing letters-sent books		I	l	l		10,734	<b></b>			
Preliminary tornado charts	224									
State tornado maps				ļ. <b></b>			ļ	775		
Mailing list furnished the Publi- cations Division	i	1		l	ì		l		l	<u></u>
cations Division										1,563
Charts for tornado predictions				1,576						ļ

^{*}Seasons of 1884, 1885, and 1886.

Statement of work performed in Tornado Division during the fiscal year ending June 30, 1886.

Subject.	Prepared and published.	Sent.	Received.	Made.	Stations opened.	Pages indexed.	Pages entered.	Supplied.	Months made.	Names listed.
Tornado circulars	1 0	•••••	1 048			••••••			•	••••••
Reports received on regular forms										
Tornado acetaces for sact com. Tornado-reporting stations Letters sent Indexing letters-sent books Preliminary tornado charts. State tornado maps. Mailing list furnished the Publications Division Charts for tornado predictions		í			*********	••••••	•••••	•••••	••••••	177

^{*} Eight months and twenty days, seasons of 1885 and 1886. † Prepared, but not published.

#### MISCELLANEOUS.

One professional paper is now in course of preparation, upon which the following work has been accomplished: Thirty-four State maps have been carefully drawn on tracing paper, upon which has been located the tracks of all of the tornadoes reported as occurring in the various States and Territories since the 10th of June, 1682. Two hundred and fourteen pages of tabulated tornado records have been prepared, embracing the period from 1682 to 1865, inclusive.

Fifty-five pages of sundry matter, mostly tables, have also been prepared.

It will require about one month of steady work to complete the manuscript for this

During the year ending June 30, 18%, the manuscript for a paper entitled "Charts of Storm Frequency for a portion of the North Atlantic Ocean" was prepared and submitted

Nearly three months' work for one man was given to the examination of old records in the Congressional Library and in the office of the Chief Signal Officer for the purpose of obtaining information concerning the occurrence of past tornadoes.

Card indices for over 1,500 storms were prepared for the tornado and local storm rec-

ord books.

Very respectfully, your obedient servant,

JNO. P. FINLEY, Second Lieutenaul, Signal Corps, U. S. Army.

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## APPENDIX 19.

## REPORT OF THE ASSISTANT IN CHARGE OF THE STUDY DIVISION.

STUDY DIVISION, July 15, 1886.

SIR: I have the honor to submit the following report of work done in the Study Division during the year ending June 30, 1886:

The work assigned to this division may be arranged under the following heads:

#### SCIENTIFIC CORRESPONDENCE.

Six hundred and forty letters relating to scientific matters have been referred to this room, on which appropriate action has been suggested. Among these, those requiring special attention related to questions in hygrometry, hypsometry, evaporation, solar radiation, thunder storms, tornadoes, sun spot and lunar influences on the atmosphere, cloud measurements, new stations, and publications.

#### ACCURACY OF ARCTIC GEOGRAPHY.

A thorough examination was made as to the reliability of the sextant observations made by Lieutenant Lockwood during his sledge journey on the north coast of Greenland, in which he reached the "farthest north," and the results were found to be highly satisfactory. The report thereon, made by G. E. Curtis, will appear as an appendix to Lieutenant Greely's official report of the expedition to Lady Franklin Bay.

#### TABLE FOR REDUCTION OF OBSERVATIONS.

The table of monthly constants for reduction of the barometer to sea level has been corrected for current changes, which are given in Appendix A. The usual reprint of the table has not been made, owing to the fact that a much improved method has been prepared to replace it. Much time has been given in this division to the discussion of the details of the proposed system of reducing the barometer to sea level, and finally all papers were referred to Professor Ferrel, with instructions to decide on the questions at issue and to prepare the tables.

#### LOCATIONS OF STATIONS.

The latitude, longitude, elevation, and magnetic variation of Signal Service and voluntary stations have been furnished as needed. In proportion as the barometric work of the service becomes more accurate, the errors of crude railroad levelings become more troublesome, so that it is becoming more and more desirable that the elevations of our stations should be based upon accurate levels made by the Coast and Geodetic Survey. A table compiled by Professor Hazen, containing the elevations of the barometers at all stations in the service on January 1, 1885, is given in Appendix B, together with all changes since that date.

#### EXPOSURE OF INSTRUMENTS.

(a) Barometer.—No change has been made during the year, but I consider it of increasing importance for this office to make the investigation recommended in my last annual report as to the influence of wind upon the pressure within the observer's room. A schedule of preliminary observations at Mount Washington bearing upon this point has been submitted and approved.

(b) Thermometer.—The question as to the proper exposure of thermometers in order to obtain the temperature of the air in their immediate neighborhood having been decided by the adoption of the whirling thermometer inside of a light and open wooden shelter, the principal remaining question for this division has been the location of the shelters. For local climatology these should evidently be placed so as to give the local temperatures with all their peculiarities; but for weather predictions or general dynamic

meteorology, the shelter should be so placed by elevation or otherwise as to give a temperature representative of a large mass of air. The inspection reports are regularly examined, and special inquiries are made for the purpose of detecting any irregularities in Signal Service exposures.

(c) Anemometer and rain-gauge.—Special comparative observations have been made during the year between anemometers located in and around Washington, and a report has been made upon the relative velocities recorded at neighboring Signal Service stations

throughout the country.

Observations on the influence of exposure upon the collection of the rain-gauge have continued to be made at about one-third of the Signal Service stations, including a special series at Mount Washington. From all these it is evident that a correct determination of the general wind velocity and precipitation can be obtained only by locating the instruments away from the disturbing influences of the buildings upon which they are at present very generally exposed. Even in improved locations outside of city limits it will still be important to determine the small coefficients necessary to correct the anometer readings for the effect of exposure and locality, and a plan to that end is now in hand.

Solar radiation thermometer.—Studies as to methods of eliminating the effect of exposure upon the Arago-Davy actinometer have been postponed in anticipation of the receipt of the standard instrument ordered over a year ago. Meanwhile the theory of the auxiliary apparatus has been more carefully elaborated and the experimental work as

planned will be submitted to the physical laboratory for execution.

#### TIME.

A full report has been submitted upon the details of the construction of the standard clock and the method proposed for securing standard time of the highest accuracy for the use of our stations. This report completes the transfer of this work to the physical laboratory.

BALLOON OBSERVATIONS.

The report of results obtained by Private W. H. Hammon has been completed under my own and Professor Mendenhall's joint supervision, and an introductory chapter by myself has been partly written. The temperatures and humidities observed by him are of so high a degree of accuracy as to justify special care in their comparison with meteorological laws.

Through the kindness of Messrs. James Allen & Son, of Providence, R. I., an opportunity was afforded for making meteorological observations in a balloon on June 24, 1886. This duty was assigned to junior professor H. A. Hazen at his request, and his

report has been submitted.

On account of the importance of securing the fullest information as to the construction and management of balloons for both military and meteorological purposes, Prof. S. A. King was temporarily engaged and assigned to the duty of compiling a manual on ballooning. This work was completed and will, it is hoped, be printed for the use of the service. The importance of balloon observations in the study of the atmosphere has been urged of late by meteorologists, both theoretical and practical. The anomalous phenomena frequently observed stimulate to a more thorough study of the atmosphere by this means.

INSTRUCTION.

The course of instruction for lieutentants at this office has included a series of fifty-eight lectures of about two hours each by myself, covering the following subjects: Meteorological apparatus, meteorological chartography, the various optical and thermal phenomena due to moisture, the vertical distribution of temperature, pressure and moisture, some of the results of Ferrel's, Guldberg and Mohn's, Oberbeck's, and Sprung's studies into the development and movement of storms. These lectures can be prepared as a text-book for the use of the office. I'rof. W. M. Davis, of Harvard University, has reported progress in the preparation of an elementary text-book on meteorology.

MISCELLANEOUS.

Considerable attention has been given to the character and usefulness of the sunset weather predictions telegraphed at midnight for the use of the indications officer; reports thereon have been submitted recommending improvements. Much of my time during the year has been given to work as a member of the board on verifications, the board on publications, and the board of professors.

#### PUBLICATIONS.

The following published articles have been prepared by Prof. II. A. Hazen:

The Condensing Hygrometer and the Psychrometer, American Journal of Science, December, 1885; Determination of Air Temperature, American Meteorological Journal, October, 1885; Notes on Professor Wild's article on the determination of air temperature, American Meteorological Journal, January, 1886; Thermometer Exposure, American Meteorological Journal, June, 1886.

The following papers prepared by members of this division have been accepted for

publication but not yet printed:

Recent mathematical papers: Professional paper No. VIII, Part II, by Junior Professor Frank Waldo.

Note on a solar fog-bow, by Junior Professor Frank Waldo.

Report on barometric comparisons in Europe and the United States; abstract of the same; by Junior Professor Frank Waldo.

Report on the standard clock; by Junior Professor Frank Waldo.

Charts of storm-tracks for the North Atlantic Ocean; by Lieutenant J. P. Finley.

Balloon manual; by Professor S. A. King.

Sun spots and weather predictions; by Professor Cleveland Abbe.

Thunder storm of 1884; by Junior Professor H. A. Hazen.

Report on the sextant observations made by Lieutenant Lockwood on the north coast of Greenland; by G. E. Curtis.

The following translations have been prepared for the use of this office:

Report to the international committee, August, 1886, on observations of clouds.

Discussions in the Comptes-Rendus on the effect of the earth's rotation on moving bodies.

### BIBLIOGRAPHY.

The compilation of a complete subject and author index to the literature of meteorology has been continued under the special supervision of Mr. C. J. Sawyer, who submits the following report:

On July 1, 1885, the bibliography consisted of a card author catalogue of 47,191 titles, 22,191 having been added by me to the material on hand at my assignment as editor of the bibliography, March 4, 1884. The work of the past year has been chiefly the collection of new titles, the correction and completion of those already on hand, the formation of a subject classification, the actual classification of the titles by subjects, and the preparation of an author index.

The work of collecting material has consisted of indexing periodicals, the examination of printed catalogues and special bibliographies, and manuscript catalogues and bibliographies furnished by co-operating scientists, chiefly abroad, and of the incorporation of

new titles from 147 lists of their works furnished by individual authors.

The net additions during the year, and the total number of titles in the bibliography at present, are as follows:

Periodicals, 3,375 volumes Published catalogues and bibliographies, 183 volumes Manuscript catalogues and bibliographies Author's lists (5,000 titles)	1,259 833
Total additions 1885-'86 Titles in bibliography July 1, 1885	
Titles in bibliography July 1, 1886	53,770

In addition to the new titles obtained, this work has been of the greatest importance in affording a constant means of correction and completion of the titles already on hand. The author's lists are especially valuable in insuring a full and accurate representation of the works of their respective compilers.

The most important special collection work of the year has been the incorporation of the meteorological titles from the card catalogue of the Signal Office library, and from the index catalogue of the Surgeon-General's office. I am indebted to Dr. J. S. Billings for permission to examine the unpublished portion of the latter catalogue, and for facilities afforded for periodical indexing in the library of the office.

The classification adopted is based on a plan prepared, at the request of this office, by Dr. A. Lancaster, of Brussels, which, after careful study and full revision, was submitted for criticism to several gentlemen especially interested in the subject. I am indebted for valuable suggestions to Prof. T. C. Mendenhall, of this office; Prof. Winslow Upton, of Brown University; Mr. W. M. Davis, of Harvard College; Prof. G. J. Symons, of London; Prof. E. S. Holden, of the University of California; Prof. E. Loomis, of Yale Col-

lege, and to the members of the study-room.

The classification of titles was begun about February 1, and, with the preparation of the author index, has constituted the chief work since that time. With this work of classification, however, is combined that of a careful revision of the material on hand. Constant effort is made to supply omissions and to insure fullness and accuracy; periodical indexing is continued as volumes desired are obtained, and correspondence is maintained with authors in this country and abroad. The greatest difficulty is experienced in securing a complete representation of the publications of the various meteorological observatories and services, especially the earlier series of observations. courtesy of the present directors of these institutions I am indebted for much valuable information furnished at the request of this office.

Classification by titles is so unsatisfactory that reference to the works themselves is often absolutely indispensable, and always desirable. For this purpose I have drawn upon all available resources and am under great obligations to the librarians of the city

for special facilities for reference afforded me.

The form of author index adopted is that employed by Dr. Houzeau and Lancaster in their "Bibliographie générale de l'astronomie," giving under the author, for each title, first, an abbreviation of the subject subdivision under which it is classed; second, the date of publication; third, the reference. The index is being prepared by my assistant, private E. H. Hilton, to whose systematic and thorough work the value of the bibliography and index will be largely due.

The classification has now advanced to "Fe," embracing about 15,000 titles, and the author index to "Du," including about 3,365 authors. The progress in classification was necessarily low at first, the work being largely experimental, but the present rate of progress is such as to insure the completion of the preliminary classification and au-

thor index and their revision during the present year.

In the work on the bibliography constant regard has been paid to the possible necessity for its use as a card catalogue until provision be made for its publication, and both the subject catalogue and author index are in the best form yet invented for such use. But a card catalogue is available to but few, and is adapted for use by a librarian preliminary to printing and for securing a catalogue always up to date only. reference it can never take the place of a published catalogue. The completeness and accuracy of the bibliography has been rendered possible only by the hearty co-operation of foreign meteorologists and librarians, and the constant assistance received from them renders the work an international one, and emphasizes the absolute necessity of an immediate publication. It is of the greatest importance, not only to our office, but to the scientific world at large, by whose aid it has been compiled.

In my original report, dated March 14, 1884, shortly after my assignment in charge of the bibliography, I estimated the final number of titles to January 1, 1882, as 40,500; the delay in publication has permitted more extensive additions than then contemplated, and the following estimates, based on the revision and classification of the first 15,000

titles of the bibliography, may be of interest:
Of the whole number of titles in the bibliography, about 52,000 are previous to January 1, 1882, the limit of the bibliography as originally planned and as now under classification; the balance form an incomplete supplementary catalogue of later publications. Careful estimates show that the 52,000 titles will be reduced in revision and classification to about 47,000; this number will be increased by double classification to about 50,000, of which 5,000 will be classed as observations, to be arranged later by countries and districts, with indices of places, observers, and periods. Of the balance, about

42,500 belong to meteorology proper, and 2,500 to terrestrial magnetism.

The future work will be the completion and revision of the classification and author index, preparation of a periodical list and alphabetical subject index, followed by final

revision of titles and technical preparation for publication when provided for.

### THUNDER-STORMS.

The collection and study of thunder-storm data has been carried on under the special

supervision of Prof. H. A. Hazen, who submits the following report:

The work of collecting special thunder-storm reports, undertaken in 1884, has been continued. A special thunder-storm form for the use of the regular Signal Service observers has been prepared, and these records are now directly comparable with those by special observers. Nine thousand one hundred and forty-five special reports have been received and filed, in addition to the reports of voluntary and Signal Service observers. Nine thousand one hundred and forty-five special reports have been A report on the thunder-storms of 1881 has been prepared for publication. There has also been prepared and published in the Monthly Weather Review for October, 1885, a

note on the connection between tides and thunder-storms; reports on thunder-storms for April and May, 1886, have been compiled from all records available, and printed in the numbers of the Weather Review for the corresponding months. Very extended records of the thunder-storms accompanying the destructive storms of September 8, 1885, in Ohio, have been collected and a study of them has been begun.

#### TORNADOES.

The collection and study of tornado data was carried on as hitherto under the general Supervision of Lieutenant Finley, until its removal, May 13, 1886, to a separate division entirely under his control.

Reports on methods of verifying tornado predictions have been made by Prof. H. A.

Hazen and Sergt. G. E. Curtis.

In general the quantity of work accomplished in this division during the past year has been materially diminished, not only by the diminution of clerical force and the transfer of the tornado subdivision, but also by the illness of Professor Waldo, who has been on sick leave, and by reason of an unfortunate accident to myself.

Respectfully submitted.

CLEVELAND ABBE, Professor and Assistant.

The CHIEF SIGNAL OFFICER OF THE ARMY.

### APPENDIX 19 A.

The following additions to and changes in the table of monthly constants for the reduction of barometric observations to sea level and standard gravity, as issued in General Orders No. 6, 1885 (and published as Appendix 66 b, annual report of the Chief Signal Officer for 1885), have been authorized during the year ending June 30, 1886:

ď	Com	bined	reduct	ion co	nstant	t (grav	ity an	d elev	ation)	for ea	ch mo	nth.
Elevation	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
80 1,384 2,603	0.09 1.54 2.86	0, 09 1, 53 2, 84	0.09 1.51 2.80	0.00 1.47 2.72	0.09 1.42 2.63	0, 09 1, 40 2, 57	0, 09 1, 39 2, 56	0, 09 1, 39 2, 56	0.09 1.42 2.63	0.09 1.46 2.70	0.09 1.51 2.81	0.05 1.5 2.8
270 1,745 B3,000 1,490	0, 27 1, 88 3, 10 1, 77	0. 27 1. 88 3. 09 1. 75	0, 27 1, 85 3, 04 1, 72	0. 27 1. 82 2. 99 1. 66	0. 26 1. 79 2. 97 1. 59	0, 26 1, 75 2, 88 1, 56	0. 26 1. 76 2. 90 1. 51	0.26 1.74 2.90 1.55	0. 26 1. 79 2. 92 1. 59	0. 26 1. 82 2. 99 1. 64	0.27 1.89 3.08 1.71	0. 2. 1. 90 8. 10 1. 80
1.018 1,234 222 339	1, 43 0, 21 0, 34	1, 43 0, 21 0, 34	1, 12 1, 35 0, 21 0, 33	1.11 1.35 0.20 0.33	1.29 0.20 0.33	1, 28 0, 20 0, 33	1.06 1.27 0.20 0.33	1.07 1.27 0.20 0.33	1.08 1.30 0.20 0.33	1.11 1.34 0.21 0.33	1.39 0.21 0.33	1.4 0.2 0.8
	1, 384 2, 603 270 1, 745 B 3,000 1,490 1,018 1,234 222 339	80 0.09 1,384 1.54 2,603 2.86 270 0.27 1,745 1.88 B3,000 3.10 1,490 1.77 1.018 1.15 1,234 1.43 222 0.21	80 0.09 0.09 1,384 1.54 1.53 2,863 2.86 2.84 270 0.27 0.27 1,745 1.88 1.89 1,490 1.77 1.75 1.018 1.15 1.15 1,234 1.43 222 0.21 0.21 0.23 0.34 0.34 0.34	80 0.09 0.09 0.00 1,384 1.64 1.53 1.51 2,603 1.74 1.75 1.78 1.88 1.85 1.85 1.85 1.85 1.49 1.77 1.75 1.72 1.018 1.15 1.15 1.15 1.21 1,234 1.43 1.43 1.39 222 0.21 0.21 0.21 0.21 0.21 0.21 0.33 0.34 0.33 0.34 0.33 0.34 0.33 0.34 0.33 0.34 0.33	10   12   12   13   14   15   17   17   17   17   17   17   17	No.   No.	Second   S	No.   No.	Second   S	S0   0.09   0.09   0.09   0.09   0.09   0.09   0.09   1.384   1.54   1.53   1.51   1.47   1.42   1.40   1.39   1.39   1.42   2.603   2.86   2.84   2.80   2.72   2.63   2.57   2.56   2.56   2.63   2.65   2.64   2.80   2.72   2.63   2.57   2.56   2.56   2.63   2.64   2.80   2.72   2.63   2.57   2.56   2.55   2.56   2.63   2.63   2.64   2.80   2.72   2.63   2.57   2.56   2.55   2.63   2.63   2.64   2.80   2.72   2.63   2.57   2.56   2.55   2.63   2.63   2.63   2.63   2.63   2.63   2.63   2.63   2.63   2.63   2.63   2.63   2.63   2.63   2.63   2.63   2.63   2.63   2.63   2.63   2.63   2.63   2.63   2.63   2.63   2.63   2.63   2.63   2.63   2.63   2.63   2.63   2.63   2.63   2.63   2.63   2.63   2.63   2.63   2.63   2.63   2.63   2.63   2.63   2.63   2.63   2.63   2.63   2.63   2.63   2.63   2.63   2.63   2.63   2.63   2.63   2.63   2.63   2.63   2.63   2.63   2.63   2.63   2.63   2.63   2.63   2.63   2.63   2.63   2.63   2.63   2.63   2.63   2.63   2.63   2.63   2.63   2.63   2.63   2.63   2.63   2.63   2.63   2.63   2.63   2.63   2.63   2.63   2.63   2.63   2.63   2.63   2.63   2.63   2.63   2.63   2.63   2.63   2.63   2.63   2.63   2.63   2.63   2.63   2.63   2.63   2.63   2.63   2.63   2.63   2.63   2.63   2.63   2.63   2.63   2.63   2.63   2.63   2.63   2.63   2.63   2.63   2.63   2.63   2.63   2.63   2.63   2.63   2.63   2.63   2.63   2.63   2.63   2.63   2.63   2.63   2.63   2.63   2.63   2.63   2.63   2.63   2.63   2.63   2.63   2.63   2.63   2.63   2.63   2.63   2.63   2.63   2.63   2.63   2.63   2.63   2.63   2.63   2.63   2.63   2.63   2.63   2.63   2.63   2.63   2.63   2.63   2.63   2.63   2.63   2.63   2.63   2.63   2.63   2.63   2.63   2.63   2.63   2.63   2.63   2.63   2.63   2.63   2.63   2.63   2.63   2.63   2.63   2.63   2.63   2.63   2.63   2.63   2.63   2.63   2.63   2.63   2.63   2.63   2.63   2.63   2.63   2.63   2.63   2.63   2.63   2.63   2.63   2.63   2.63   2.63   2.63   2.63   2.63   2.63   2.63   2.63   2.63   2.63   2.63   2.63   2.63   2.63   2.63   2.63   2.63   2.63   2.63   2.63	SO   0.09   0.09   0.00   0.00   0.09   0.09   0.09   0.09   0.09   1.384   1.54   1.53   1.51   1.47   1.42   1.40   1.39   1.39   1.42   1.46   2.603   2.86   2.84   2.80   2.72   2.63   2.57   2.56   2.56   2.63   2.70   2.71   2.63   2.72   2.63   2.57   2.56   2.63   2.70   2.71   2.63   2.72   2.63   2.72   2.63   2.75   2.56   2.63   2.70   2.71   2.71   2.71   1.75   1.75   1.76   1.74   1.79   1.82   1.88   1.88   1.88   1.85   1.82   1.79   1.75   1.76   1.74   1.79   1.82   1.89   1.40   1.39   1.42   1.40   1.39   1.42   1.40   1.39   1.42   1.40   1.39   1.42   1.45   1.45   1.45   1.45   1.45   1.45   1.45   1.45   1.45   1.45   1.45   1.45   1.45   1.45   1.45   1.45   1.45   1.45   1.45   1.45   1.45   1.45   1.45   1.45   1.45   1.45   1.45   1.45   1.45   1.45   1.55   1.55   1.55   1.55   1.55   1.55   1.55   1.55   1.55   1.55   1.55   1.55   1.55   1.55   1.55   1.55   1.55   1.55   1.55   1.55   1.55   1.55   1.55   1.55   1.55   1.55   1.55   1.55   1.55   1.55   1.55   1.55   1.55   1.55   1.55   1.55   1.55   1.55   1.55   1.55   1.55   1.55   1.55   1.55   1.55   1.55   1.55   1.55   1.55   1.55   1.55   1.55   1.55   1.55   1.55   1.55   1.55   1.55   1.55   1.55   1.55   1.55   1.55   1.55   1.55   1.55   1.55   1.55   1.55   1.55   1.55   1.55   1.55   1.55   1.55   1.55   1.55   1.55   1.55   1.55   1.55   1.55   1.55   1.55   1.55   1.55   1.55   1.55   1.55   1.55   1.55   1.55   1.55   1.55   1.55   1.55   1.55   1.55   1.55   1.55   1.55   1.55   1.55   1.55   1.55   1.55   1.55   1.55   1.55   1.55   1.55   1.55   1.55   1.55   1.55   1.55   1.55   1.55   1.55   1.55   1.55   1.55   1.55   1.55   1.55   1.55   1.55   1.55   1.55   1.55   1.55   1.55   1.55   1.55   1.55   1.55   1.55   1.55   1.55   1.55   1.55   1.55   1.55   1.55   1.55   1.55   1.55   1.55   1.55   1.55   1.55   1.55   1.55   1.55   1.55   1.55   1.55   1.55   1.55   1.55   1.55   1.55   1.55   1.55   1.55   1.55   1.55   1.55   1.55   1.55   1.55   1.55   1.55   1.55   1.55   1.55   1.55   1.55   1.55	80 0.09 0.09 0.09 0.09 0.09 0.09 0.09 0.

¹ Moved August 1, 1885.

² New station. ³ Revised elevation.

⁴ Moved Nov. 1, 1885.

Moved May 1, 1886.
 Moved May 11, 1886.
 Revised elevation.

B = Barometric determination.

## APPENDIX 19 B.

## Study Division-Annual report.

## Latitude, longitude, and elevation of Signal Service barometers.

Stations.	Latitude.	Longitude.	Elevation January 1, 1885.	Remarks.
Abilene, Tex	o / 32 14	99 45	Feel.	Established June 30, 1835. H=
Albany, N. Y.	42 39	73 45	83	1,744 feet.
Albena, Mich	45 5	83 30	609	
Apache, Fort, Ariz	33 48 48 32	109 57	5,050 B	•
Atlanta, Ga	15 32 33 45	109 42 84 23	2,720 B 1,129	
Auantio City, N. J	39 22	74 25	13	
Augusta, Ga	33 28	81 54	183	
Baltimore, Md. Barnegat City, N. J. Behring's Island, Behring Sea	39 18 39 46	76 37 74 6	45 22	
Behring's Island, Behring Sea	55 12	East 165 55	20	
bennett, Fort, Dak	44 43	100 39	1,510 B	
Senton, Fort, Mont Sidwell, Fort, Cal	47 50 41 53	110 40 120 11	2,681 B	Established September 9, 1835.
Sismarck, Dak	46 47	100 38	1,694	Established Schember 9, 1869.
Slock Island, R. I	41 10	71 36	27	
Boise City, Idaho	43 87	116 8	2,750B	
Roston, Mass. Bridger, Fort, Wyo	42 21 41 28	71 4 110 30	124	
Brownsville, Tex	25 53	97 26	57	
Buffalo, N. Y	42 53	78 53	690	
MIOIU, POIT, DAK	48 0	103 56	1,930 B	
airo, Ill	37 0 46 16	89 10 124 4	359 179	
anby, Fort, Wash ape Henry, Va. ape May, N. J.	36 56	76 0	16	
ape May, N. J	88 56	74 58	27 637	
ape mendocuno, Cal	40 26	124 24		
edar Keys, Flaharleston, S. C.	29 8 32 47	83 2 79 56	22 52	
harleston, S. Charlotte, N. C	35 13	80 51	8.8	
hallanooga, Tenn	35 4	85 15	783	
beyenne, Wyo	41 8	104 48	6, 105	
hicago, Ill	41 52 37 55	87 38 75 23	661 8	
hincoteague, Va. incinnati, Ohio	39 6	84 30	612	Moved March 1, 1885. H=628 feet
everand, Unio	41.30	81 42	GUO	,
Columbus, Ohiooncho, Fort, Tex	39 58	83 0 100 24	812	
Concordia, Kans.	31 25 39 25	97 41	1,900 B	Established May 1, 1885. H=1,38
		}		feet.
uster, Fort, Mont		107 34	3,040 B	
avenport, Iowaavis, Fort, Tex	41 30 30 38	90 38 103 56	615 4, 928, B	
ayton, Wash	46 19	117 56	1,683, B	·
eadwood, Dak	41 23	103 43	4, 600, B	
enver, Colo	39 45	105 0	5, 254	
es Moines, Iowa Detroit, Mich	41 35 42 30	93 37 83 3	819 672	
lodge City, Kans	37 45	100 0	2,517	
pubuque, Iowa	42 30	90 44	665	
oluth, Minn	46 48	92 6	672	
Eastport, Me	44 54 35 30	66 59 100 21	2,650, B	
4 PMO. Tex	· 31 47	106 30	3,764, B	•
rie, Pa	42 7	80 5	G81	
ecanaba, Michort Smith, Ark	45 48 35 22	87 5 91 24	613 451	Moved August 8,1885, II=608 fort Moved February 1, 1885, II=470
t Suita, Ark	45 Z2	9121	371	feet.
risco, Utah	38 25	113 16	ļ <b></b>	Established January 25,1995. II ·
alveston, Tex	29 18	94 47	40	· ·
rand Haven, Mich	43 5 32 39	85 18 109 57	65) 4,856, B	
rant, Fort, Ariz	32 39	96 51	9,55, D 8/7	
reencastle, Ind	35 15	75 40	12	
lelena, Mont	46 34	112 4	4,000	
uron, Dak	44 21	98 9 86 10	1,3/7 766	
ndianapolis, Ind ndianola, Tex	39 46 28 32	96 31	26	•
eksonville, Fla.	30 20	81 20	- Z	

Latitude, longitude, and elevation of Signal Service barometers-Continued.

Stations.	Latitude.	Longitude.	Elevation January 1,1885.	Remarks.
	0 /	0 /	Feet.	7.4.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.
Keeler, Cal	36 35	117 50	***********************	Established July 1, 1885. H=3, 636 feet.
Keokuk, Iowa	40 22	91 26	618	
Key West, Fla Kitty Hawk, N. C	24 34	81 49	20	, ·
Kitty Hawk, N. C	36 0 35 56	75 42 83 58	980	
Knoxville, Tenn	43 49	91 15	725	
Lamar, Miss	37 32	94 15		Established Feb. 26,1885, H=1,02
Yandania Mana	39 19	94 57	842	feet.
Leavenworth, Kans Lewiston, Idaho	46 8	117 5	785	
Little Deale Anle	34 45	92 6	288	
Los Angeles, Cal	34 3	118 15	339	
Louisville, Ky	38 15	85 45	551	)·
Los Angeles, Cal.  Louisville, Ky Lynchburg, Va Mackinaw City, Mich.  Macon, Fort, N. C.  Maginnis, Fort, Mont.	37 25 45 47	79 9 84 39	652 605	[
Macon Fort N C	34 42	76 40	11	
Maginnia Fort Mont	47 12	109 10	4,340B	P
Marquette, Mich	46 34	87 24	672	
Marquette, Mich Memphis, Tenn	35 9	90 3	320	
Milwaukee, Wis	43 2	87 54	697	
Mobile, Ala	30 41 32 23	88 2 86 18	35	
Montgomery, Ala		107 56	219	Established Nov. 1, 1885. H=?
Moorhead, Minn	46 52	96 44	926	12000 1107. 1, 1000, 11—1
Mount Washington, N. H	44 16	71 18	6,279	
Myer, Fort, Va Nashville, Tenn	38 53	77 4	267B	
Nashville, Tenn	36 10	86 47	549	
New Haven, Conn New London, Conn	41 18 41 21	72 56 72 5	107 47	
New Orleans, La		90 4	52	· ·
New York City	40 43	74 0	164	Moved April 1, 1886. H=168.'
Norfolk, Va North Platte, Nebr	36 51	76 17	30	
North Platte, Nebr	41 8	100 45	2,841	
Olympia, Wash	47 3 41 16	122 53 95 56	36	
Omaha, Nebr Oswego, N. Y Palestine, Tex	43 29	76 35	1,113	P .
Palestine Tex	31 45	95 40	533	
Pensacola, Fla	30.25	87 13	30	
Philadelphia, Pa	39.57	75 9	117	
Pike's Peak, Colo	38 50 40 32	105 2 80 2	14, 134 771	
Poplar Pivar Mont	48 8	105 10	2,030B	
Pittsburg, Pa Poplar River, Mont Port Angeles, Wash	48 7	123 6	*************************	Established Feb, 1, 1885. H=14'.
Port Huron, Mich	43 0	82 26	633	
Portland, Me Portland, Oreg	43 39 45 32	70 15 122 43	45	Moved July 1, 1885. H=99'.
Prescott, Ariz	34 33	112 28	5, 389B	Moved August 1, 1885. H=80'.
Red Bluff, Cal	40 10	122 15	337	
Rio Grande City, Tex	26 23	98 48	230B	
Rio Grande City, Tex Rochester, N. Y Roseburg, Oreg	43 8	77 42	621	
Roseburg, Oreg	43 13	123 20	523	
Sacramento, Cal Saint Louis, Mo	38 35 38 38	121 30 90 12	571	
Saint Michael's, Fort, Alaska.	63 28	161 48	30	
Saint Paul, Minn	44 58	93 3	801	Moved July 1, 1885. H=831'.
Saint Vincent, Minn	48 56	97 14	804	
Salt Lake City, Utah San Antonio, Tex.	40.46	111 54	4,348	Petablished Manch 7 1995 TI - 7014
San Diego, Cal	29 27 32 43	98 28 117 10	67	Established March 7, 1885. H=781
andusky, Ohio	41 25	82 40	638	
Sandy Hook, N. J	40.28	74 0	28	
Sanford, Fla	28 48	81 23	25 B	
San Francisco, Cal	37 48	122 26	60	The Author and Tours of Appendix one
San Luis Obispo, Cal Santa Fé, N. Mex.	35 18 35 41	120 39 105 57	7 020	Established June 1, 1885. H=270
Savannah, Ga.	32 5	81 5	7,020 87	1
Shaw, Fort. Mont.	47. 31	111 48	3,550 B	
Shreveport, La.,	32 30	93 40	227	
Sill, Fort, Ind. T	34 40	98 23	1,200B	
Sitka, Alaska Smithville, N. C. Spokane Falls, Wash	57 3 33 55	135 19 78 1	63	
Spokane Falls Wash	47 40	78 1 117 25	1,909	
Springheld, III.	39.48	89-39	644	
Stanton, Fort, N. Mex	33 30	105 26		Established Nov. 1, 1885. H=?
Stockton, Fort, Tex	30.53	102.53	3,010 B	

Latitude, longitude, and elevation of Signal Service barometers-Continued.

Stations.	Latitud	le.	Longitue	de.	Elevation January 1, 1885.	Remarks.
Sully, Dak	°		100		Fect.	Established Nov. 24, 1885. H=?
Tatoosh Island, Wash	48		124		86	22,000,000,000,000,000,000,000,000,000,
Thomas, Fort, Ariz	33		110		2,710B	
Toledo, Obio	41	40	83	34	651	
Totten, Fort, Dak	47		98	57	1,500	Moved Oct. 1885. H=1, 490'; and May 1, 1896. H=1, 487'.
Unalaska, Alaska	53	53	166	82	13	
Valentine, Nebr	42	50	100	32		Established Sept. 1, 1885; $H=2603$ .
Vicksburg, Miss	32	22	90 8	53	244	Moved April 21, 1885; H=252. June 1, 1885, 209; May 11, 1886. H=222.
Walls Walls, Wash	46	2	118 :	20 l		Established Nov. 25, 1885, H=1018
Washington City	88		77		106	
West Las Animas, Colo	38		103		8,899	
Wilmington, N. C.	34	14	77		52	
Winnemucca, Nev	40	58	117	43	4, 358	
Yankton, Dak	42	54	97 :	28	1,228	Moved May 1, 1886. H=1234.
Yuma, Ariz	82	45	114	86	141	, ,

### APPENDIX 20.

## BEPORT OF OFFICER IN CHARGE OF THE FACT AND INTERNATIONAL BULLETIN DIVISION.

SIGNAL OFFICE, WAR DEPARTMENT, Washington City, June 30, 1886.

GENERAL: I have the honor to submit herewith a brief statement of the work of the Fact and International Bulletin Division during the year ending June 30, 1886, as called for by memorandum No. 167.

I am, very respectfully, your obedient servant,

H. II. C. DUNWOODY.

First Lieutenant, Fourth Artillery, Acting Signal Officer and Assistant.

The CHIEF SIGNAL OFFICER OF THE ARMY.

### FACT AND INTERNATIONAL BULLETIN DIVISION.

The Monthly Weather Review of the Signal Service has been regularly published during the year, and, with increased facilities for securing reliable data, it forms one of the most valuable publications of this service. Each leview contains a general summary of the meteorological data collected by this office during the month. The introduction gives a brief statement of the weather conditions throughout the country and the probable effect of the same upon the agricultural products of each section. The monthly means of temperature and rainfall, compared with the normal temperature and average rainfall for each district, are published in tabular form. Similar tables referring specially to the cotton region are given, based upon cotton-region reports. These tables have increased in value, as they afford means of comparison between the meteorological conditions and their probable effect upon the crop.

The increased number of marine reports which are received in time to be utilized in tracing storms from the continent over the North Atlantic, render it possible to more accurately give the probable tracks of these storms on the monthly charts accompanying

the Review, thus affording information specially valuable to shipmasters.

The Monthly Summary and Review of International Meteorological Observations contains a summary of the reports published in the International Bulletin and a general discussion of the meteorological conditions prevailing over the Northern Hemisphere. These observations have been published since 1873, and furnish a valuable collection of data for the solution of the great problems of meteorology.

It is within the province of this division to investigate atmospheric phenomena of an unusual nature embodied in reports received; to deduce results therefrom, and cause the same to be issued as special charts or publications. A number of these special papers have been compiled and published during the past year, and embrace data of great im-

portance and practical value.

### APPENDIX 21.

### ANNUAL REPORT OF SIGNAL SERVICE AGENCIES.

NEW YORK CITY, July 3, 1886.

SIR: I have the honor to transmit the following report on Signal Service agencies for the past fiscal year:

For the benefit of commerce agencies have been maintained in Boston, Philadelphia, and New York City, where 4,072 ships' barometers were compared with Signal Service

standards, errors determined, and correction cards furnished.

Simultaneous observations during the year have been received on Forms 123, from 352 steamers and 156 sailing vessels, showing an increase of 89 since last report. In addition to this the New York Herald weather bureau supplied the service with reports from 73 vessels, which, added to our own, makes a grand total of 581 vessels on which observations have been made for the weather bureau. In connection with this the number of forms examined amounted to 5,486, and the number of letters and acknowledgments prepared and forwarded reached 3,739. Letters received numbered 570.

Abstracts of logs from vessels to the number of 557 have been prepared and forwarded; besides, the New York Herald furnished us with 171, and the New York Maritime Reg-

ister with 521 additional.

Storm reports were received to the number of 776.

Cablegrams to London were forwarded during the year to the number of 99 from New

York agency, and from agency at Boston 26 were sent.

These telegrams gave specific data obtained from incoming steamers, showing location of icebergs and derelict ships observed, and position and bearing of storms encountered west of the forty-fifth meridian.

The relations between the shipping interests and the Signal Service agencies are extremely pleasant. The weather bureau stands better to-day than it has ever stood before with commercial interests of the country.

Very respectfully, your obedient servant,

II. J. PENROD, Sergeant, Signal Corps, U. S. Army.

The CHIEF SIGNAL OFFICER OF THE ARMY.

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### APPENDIX 22.

# ANNUAL REPORT OF THE ASSISTANT IN CHARGE OF THE PHYSICAL LABORATORY DIVISION.

WASHINGTON CITY, July 19, 1896.

SIR: I have the honor to report as follows concerning the work of the Physical Labor-

atory Division during the fiscal year ending June 30, 1886:

The number of instruments received and issued within the year reached nearly five thousand. The greater part of the work of receiving and issuing instruments is done in what is known as the "instrument room." Packing is done there and all records in reference to the condition and location of the instruments are kept there. Several improvements in the method of packing have been introduced through which the number of breakages occurring in transit has been greatly diminished. A few changes in the method of keeping the accounts and records have also been made with the object of enabling the complete history of every article handled to be more immediately accessible.

Nearly two hundred and fifty barometers were compared in this room, with the substandards provided, and over one hundred anemometers were tested. All barometers are here repaired and filled, requiring the distillation of 300 pounds of mercury during the year. Considerable attention was given to the improvement of the self-registering instruments. Ink pens have been substituted for pencils, and the records have been greatly improved in this way. As a check upon the care with which the record sheets are placed, one sheet has been taken, at random, and without previous notice, each month and carefully compared with the regular records of the non-registering instruments. At least 1,500 people have visited the room during the year, requiring a great deal of time from an attendant in explaining the operations of the various instruments.

Work in the other rooms occupied by the division consisted largely of the comparison of thermometers and rain-gauges, together with the study of instruments with a view to their improvement, the suggestions of new forms, &c. Much time during the year was given to the preparation of detailed specifications, with drawings of the various instruments used by the service, to enable the property officer to make purchases in accordance with the requirements of the law. New forms have been introduced, and experimental studies of instruments have been made, as will be seen in the following brief résumé:

Barometers.—Considerable progress toward the establishment of a normal barometer was made during the year. A cathetometer for use in connection with the same was made by the Societé Genevise according to plans prepared in the division. It has been received and is found to be entirely satisfactory. Some experiments were also made to determine the best method of reading the height of a mercurial column, such as will be used in the new normal. On the last two days of each month comparison of the five standard barometers now in the office were made, and to increase the accuracy of reduction to a common level a precise measurement of the difference in the elevation of those in the "instrument room" and those in the testing room was made. A study was made of the temperature of the mercury at different points in the column of an ordinary barometer for the purpose of determining the accuracy with which the same is represented by that of the attached thermometer.

Thermometers.—Careful comparison of fourteen substandards received from Kew were made with substandards already in the office, which had previously been compared with the air thermometer, and a report on the comparison of substandards with the air

thermometer was furnished and is now ready for publication.

Nearly a thousand working thermometers were compared with the office substandards, more than one-quarter of the number being for persons not connected with the service. The comparison generally extended from —28° F. to +112° F. A study of the relative sensitiveness of spherical and cylindrical bulb thermometers was made, at the conclusion of which an order was issued by the Chief Signal Officer declaring that the latter form should in the future be used to the exclusion of the former, except in the case of maximum and minimum thermometers. As it had been suspected that the indices of minimum.

mum thermometers were sometimes jarred out of their proper position by wind, passing railway trains, &c., the question was made the subject of experiment, resulting in a recommendation that the thermometers be placed in a horizontal position instead of in-

clined as was previously the custom.

Psychrometers.—The subject of hygrometry received a good deal of attention in the early part of the year. A large number of comparisons of the sling psychrometer and dewpoint apparatus under varying conditions of temperature and humidity, together with those made on Pike's Peak and elsewhere, furnished the necessary data for the computation of reduction tables for the whirling psychrometer.

A machine for whirling the thermometers was devised and adopted, and the operation of supplying stations with the new instrument was commenced. Fifty stations were first selected to which machines were sent. A further issue of fifty will very shortly be made. For purpose of comparison the old wet and dry bulb psychrometer will remain at these

stations for a few months and will be read regularly with the new instruments.

Anemometers. —Improvements were made in the anemometer, consisting mainly of the introduction of oil-cups at both the upper and lower bearing of the spindle. portance of securing a better standard of anemometry has been constantly recognized, but, owing to a lack of facilities, no steps in that direction have been taken. Under these circumstances it was deemed desirable to preserve the existing standard as carefully as possible, and to this end two new anemometers were selected, which agreed very closely with that so long in use. These were accepted as representing the standard, one of them being used daily for purpose of comparison, and the other being set aside for periodic comparison with the first.

Anemometer supports.—Considerable difficulty has always been experienced in the use of the anemometer support of the telescopic form. A new form was adopted in the past year which it is believed will be free from any serious objections. Unfortunately its use requires a good deal of roof-space, so that at a few of the stations either the telescopic rod or the T-iron support first used about two years ago must be retained.

Rain-gauges. —The new 8-inch rain-gauge is being introduced with considerable rapid-Nearly one hundred and fifty were received during the year. All are carefully calibrated, and a correction-card is furnished with each. A large number of cheap raingauges, 3 inches in diameter, were furnished to the observers in the cotton-belt region.

Wind vanes.—Preparations have been made for the introduction of smaller vanes than have generally been in use. The large 16-foot vane is unquestionably too sluggish in its action, and it is proposed to substitute one not unlike what is known as the vane" wherever new vanes are required. As this vane has possibly too great freedom of movement, a method of damping its motion has been proposed and will be tried.

Atmospheric electricity. - Much progress was made in the study of this subject during For the purpose of investigating electrometers, collectors, and exposures, a "mast" was erected on the roof of the building 1704 G street, by means of which two collectors can be simultaneously exposed at a height of 40 feet above the roof. During the winter numerous experiments were made with water-dropping collectors, at various heights, and joined to different electrometers. Specifications for a modified form of Mascart's electrometer were prepared, and six instruments were ordered for use during the present year.

In January several new stations for special observations in atmospheric electricity were established by order of the Chief Signal Officer, and through the courtesy of the authorities of several educational institutions. The new stations are at New Haven (Yale College), Ithaca (Cornell University), Columbus (Ohio State University), and Boston (Institute of Technology). The latter station was established on the removal of that pre-viously existing at Cambridge. The station at Baltimore has continued as before. The following assignments to these stations were made: Columbus, Sergeant McRae; Ithaca, Private Hammon; New Haven, Private Fassig; Boston, Private Schultz. The station

at Baltimore has continued in charge of Sergeant Morrill.

Photographic registration was maintained at Baltimore. At the other stations observations are made at stated intervals. At Columbus, Ithaca, and New Haven the observations have been carried on by the use of the electrometers belonging to the colleges located at these points, for which the Service is indebted to the kindness of Professor Thomas, at Columbus, Professor Anthony, at Ithaca, and Professor Wright, at New In addition, Professor Cross, at Boston, has shown great interest in the work, and has facilitated the making of observations at that point in many ways. Professor Rowland and the authorities of the Johns Hopkins University have continued to afford the excellent facilities originally provided for the observer at that point. A great deal of time was required to get these new stations in working order, but in April a series of simultaneous observations made every five minutes and extending over three days was made at all, and at the Office of the Chief Signal Officer. The results of these observamade at all, and at the Office of the Chief Signal Officer. tions have been charted and partially studied, with interesting results.

The observers at these special stations were instructed to make frequent observations during the passage of thunder storms, and a number of interesting results of such studies have been received. Much interesting work has been done in this city by means of simultaneous observations at this office and at the Smithsonian Institution. A station has been temporarily established at the latter point through the kindness of the Secretary, Professor Spencer F. Baird, and recently an electrometer and collector have been mounted at the summit of the Washington Monument, through the courtesy of Col. T. L. Casey, Corps of Engineers, U. S. A., in charge. These local observations will be continued for some time at intervals, as the results promise to be of great value. With the receipt of the new electrometers it will be possible to equip the distant stations uniformly and to increase the number of local stations, so that far more satisfactory work will be done in the near future.

In connection with the subject of atmospheric electricity, it may be mentioned that a series of experiments are under way for the purpose of determining the proper form and dimensions of lightning-rod "grounds." This is a matter of great importance, and

the results of the investigation will be of great practical value.

Ground temperatures.—The experimental study of methods of measuring ground temperatures by means of electricity has been kept up during the greater part of the year, with very satisfactory results. Two forms of electrical thermometers have been devised and tested, and they have been found to be reliable in their indications. A new form of Wheatstone's bridge has just now been constructed, which, it is believed, will render the whole apparatus complete and satisfactory. As soon as it has been tested arrangements will be made for procuring a number; the galvanometers for this purpose have already been ordered, and it is expected that during the coming year the regular observations of earth temperature may be begun at several stations. A new form of electric air thermometer of extreme sensitiveness has grown out of this investigation, and it is expected to be useful in determining certain questions.

Observations of underground water temperatures (that of water in buried mains) have been carried on through the year by Prof. E. S. Morse, of Salem, Mass., and Maj. John Gould, of Portland, Me., who kindly volunteered to do this work, and to whom

the Service is indebted for a series of interesting and valuable results.

A large amount of work of a miscellaneous character has been done by the division during the year. Much of it consisted in attendance upon board meetings for the consideration of various subjects, and in the preparation of special papers and reports upon matters which were referred to the professor in charge for consideration. A good deal of miscellaneous experimental work was done in the laboratory, including important tests of cables and wires of various kinds, submitted to the Service for examination, and especially in connection with the testing before laying and testing in position of the Nantucket cable, and the examination and testing of the Block Island cable, to determine whether or not it could be repaired.

All of the work of the division has been greatly hampered and much of the time interrupted by its inconvenient and totally inadequate quarters. The rooms are often crowded with instruments to be tested or preparing for shipment, and much delicate and expensive apparatus necessary to the work of the division is continually exposed to danger and loss from breakage and other causes. That more commodious and better quarters for the division are imperatively demanded will be immediately recognized upon an inspection of those now occupied, and it is respectfully urged that it is an unwise economy on the part of the Government which allows so much valuable property

to remain so poorly housed and protected.

Very respectfully,

T. C. MENDENHALL, Professor in Charge Physical Laboratory Division.

The CHIEF SIGNAL OFFICER OF THE ARMY.

### APPENDIX 23.

REPORT OF PROFESSOR WILLIAM FERREL, ASSISTANT, ON REDUCTION OF BAROMETRIC PRESSURE TO SEA-LEVEL AND STANDARD GRAVITY.

In ascending through the atmosphere the barometric pressure gradually becomes less in proportion to the mass of air left below. The weight of a column of air of any given base between the station of observation and sea-level, expressed by the height of a mercurial column of the same base at the temperature of freezing which exactly counterpoises this column of air, is the reduction to sea-level. But on account of the varying force of gravity between the equator and the pole the same column of mercury presses more at the same altitude in higher than in lower latitudes, and on the same parallel of latitude it presses a little more at sea-level than at some elevation above sea-level. In order, therefore, to have a definite and unvarying measure of barometric pressure it is necessary to know the height of the counterpoising mercurial column when subject to the action of some standard force of gravity. This is assumed to be that of sea-level on the parallel of 45°. The reduction of the height of the counterpoising barometric column to the height which it would have if subject to the force of this standard gravity, is called the reduction to standard gravity. Both of these reductions are included in the same formula, which is simply a reversing of the hypsometrical formula.

In this formula, strictly, the mean temperature of the air column is required, but this is generally not accurately known, and at most only that of the lower and upper stations, and then the best that can be done generally is to take the mean of the temperature at these stations, though this may differ considerably from the true mean of the whole column. But using this as the true temperature, the formula of reduction to sealevel gives the true reduction, and in this case it becomes a definite matter readily un-

derstood.

In the case in which the upper station is on a high plateau or mountain top, the question, what is the reduction to sea-level, is not so easily answered, and the matter becomes less definite. In this case there is no air column between the upper station and sea-level, and the conception of what reduction to sea-level really means is not so clear. The best that can be done is to imagine that the space between the station and sea-level is occupied by air, and that this has the same temperature as the air would have if the mountain or plateau were away. But then the question arises, what would be the temperature of this air, for we have in this case only the observed temperature of the upper station, and even this, especially when on a wide plateau or in a high mountain valley, may differ very much from what the temperature of the open air would be at that altitude if the mountain or plateau were not there. And even if this were known the law of increase down to sea-level would still be unknown. Conceiving reduction to sea-level in this case to be as stated above, it is seen that it is beset with great difficulties and uncertainties, on account of our not knowing what the temperature of the air would be under the circumstances.

For the average of the year the observed air temperature at the station may be regarded as that which the air would have if the mountain or plateau were away, but in the annual, diurnal, and abnormal changes the observed temperature of the station at the surface of the mountain top or plateau may be very different from what would be observed in the open air if this were away, especially in extreme temperatures, as those of midwinter and midsummer, or of morning and afternoon, or in the case of the maximum and minimum of the abnormal changes of short period. In such cases the extremes in open air have a much smaller range than near the earth's surface, and this is especially the case in the diurnal ranges and those of abnormal changes of short period. In the annual changes of temperature there is more time for the open air to acquire somewhat the same temperature as that of the carth's surface, but even in this case the average summer temperatures are considerably greater and the average winter temperatures considerably less on the tops of mountains, and especially on high plateaus, than in the open air on the same level at some distance away.

For all parts of the United States east of the Mississippi and Missouri rivers, with few exceptions, and the adjacent parts west of these rivers to a distance where the altitudes

become considerable, the uncertainties in the temperatures to be used have only a small effect upon the reductions, but farther west, on the high plateaus both east of the Rocky Mountains and westward to the Cascade and Sierra Nevada ranges, the effect of the uncertainty becomes great. For instance, at Cheyenne, altitude 6,105 feet, an error of 1° in the temperature argument of the tables corresponds to an error of about 0.012 of an inch, and so an error of 8°, which is often possible in individual reductions, corresponds to an error of 0.1 of an inch in the reduction.

I'he pressure of the atmosphere at any point does not depend merely upon the weight of the air above it, but also upon the pressure at, and consequently upon the weight of the air on all sides above, the same level. If the temperature of the air in any given locality of small extent is increased, of course the mere weight of the column of air between the upper station and sea-level is diminished, but the effect of this difference of temperature is mainly to cause and maintain an ascending current over the warmer area, with a gradually accelerated velocity in the lower part, and the reaction of this acceleration causes an increase of pressure at the earth's surface, but at or near the surface there must be a slight gradient of pressure decreasing from the surrounding parts toward the heated interior, just sufficient to keep up a flow of air to supply the accending current. The pressure, therefore, at the base of this warmer column of air, and the difference of pressure between some upper level and sea-level, or, in other words, the reduction to sea-level, depends rather upon the weight, and consequently the temperature of the air around about the warmer column of ascending air. The case is the same where the upper station is on the top of a mountain and where the ascent of warmer air is not directly upward, but along the sides of the heated surface of the mountain. The pressure at the base and at any level up the side of the mountain depends very little upon the temperature of this warmer air, but almost entirely upon the pressures at the same levels of the air around on all sides in the vicinity of the mountain. It must be understood that we are not here considering the case in which pressure is affected by a gyratory motion of the air, but simply that in which difference of pressure depends upon difference of temperature.

In the reductions to sea-level, therefore, we need rather the general or average openair temperature of the whole region around about than the exact local air temperature; that is, we need the temperature both at the upper and lower level, which would be given by an isothermal chart based upon observations at numerous stations around extending to no very great distance, for in such a chart local abnormal variations of temperature of small extent would not come in. With such a temperature we should obtain a reduction which would correspond very nearly with that in the case of no local disturbance of temperature, and in the case of a mountain or high plateau such a reduction as would be obtained if the mountain or plateau were away and the temperature occupying its place were used, and not the temperature of the surface of the mountain or plateau, abnormally heated above, or cooled below, that of the air generally.

For the average of the year the air temperature observed at any station on a high plateau, and especially on a mountain peak or the summit of a sharp mountain range, perhaps differs but little from that of the air generally at the same level at that altitude for some distance around, or from what would be observed at that altitude if the plateau or mountain were absent. At least, where there is so much uncertainty, the best that can be done is to use this as the temperature of the upper level. But we still need the sealevel temperature which would exist if there were no mountain or plateau. Since we have no known law or rate of increase of temperature between the two levels, especially in the case of wide plateaus, which holds universally, the best that can be done is to assume a law or rate for any given region under consideration, in reducing the observed temperatures of the stations of great elevation to sea-level, which gives a system of sealevel isotherms such as would exist if there were a sea-level plane, judging as well as possible from the position and direction of such lines determined from observations at or near sea-level around about the high stations.

Such a chart, Chart I, has been formed for the whole of the United States, including the high plateau region of the western part. The sea-level temperatures of this chart for each station, as given on the chart, were obtained by reducing the temperature above to sea-level by adding one degree for each 600 feet of altitude. This is only about one-half of the usual rate obtained in various parts of the world by comparing the temperature of high mountains with those of low-level stations, and from balloon ascents in the open air, but for the reduction of the plateau stations of the western part of the United States this rate is evidently much too great, for it throws the isotherms of this region too far north, and disturbs them very much. As the two great occans in the higher latitudes have for the mean of the year, for well known reasons, a higher temperature than that of the continents on the same latitudes between, and the general tendency of the atmosphere is from west to east, it is evident that the isotherms in case of a low and level continent would have to descend from the western side down to lower latitudes until pretty well on into the interior of the continent, but nowhere lower than

they are in the Mississippi Valley, where they are determined from observations near sea-level. The adopted rate gives this form, as seen from Chart I, but if a greater rate were adopted it would make the isotherms curve very high up into the higher latitudes in the plateau region, and a smaller rate would cause them to run too low down in the lower latitudes. It is seen that the temperatures of the plateau region, reduced through so great an altitude, are a little irregular, as was to be expected, but in general they do not vary much from the temperatures as indicated by the sea-level isotherms.

On the eastern side of the Rocky Mountain range the temperatures seem to be a little abnormal and too great for the latitude. This is evidently the fehn effect of the air in descending to a lower level after having passed over the high summit of the range. The stations are too few and the temperature reductions to sea-level too uncertain to determine and lay down certainly this effect, and so no attempt has been made to indicate it

in the isotherms.

The reason that a lower rate of decrease of temperature with increase of altitude than usual is required in our western plateau may be due to the fact that the air passes from a warmer to a colder region in the mean of the year, in passing from west to east, and the upper currents, moving eastward faster than the lower ones, have a tendency to heat the air over the continent more above than below, and so to diminish this rate on the western side of the United States. But a less rate is undoubtedly required in all cases

for high plateaus than for mountain peaks and sharp mountain ranges.

The reductions of mean annual temperature to sea-level with the assumed rate of 1° for each 600 feet having given a fairly satisfactory chart of isotherms, this rate was used in deducing the sea-level temperature to be used in the barometric formula of reduction to sea-level, and thus with the observed annual mean above, both of pressure and temperature, the reduction to sea-level was obtained in the usual way. This gives the reductions of the barometric pressures for each of the several stations in Table I, corresponding to the argument of the mean temperature of the year. The mean annual temperatures and pressures used were those deduced from all the observations made from November 1, 1879, to October 31, 1863, inclusive, including a few stations opened after November 1, 1879, and consequently having an average of less than five years. With these reductions corresponding to the mean annual temperatures, the sealevel pressures, as given on Chart IV, have been obtained, the decimal figures only being given. Over the eastern part of the United States, where the altitudes, and consequently the reductions, are small, the regularity of the pressures and of the isobars are fairly satisfactory, and the observed irregularities are no doubt due mostly to errors in the railroad levelings from which the altitudes have been obtained, but of course in some measure to instrumental and other errors. The indications are that the adopted elevations of Knoxville, Chattanooga, and a few others, perhaps all depending on the same chain of railroad levelings, are a little too great.

In the western part generally of the United States the reductions and sea-level pressures are more uncertain, both on account of the uncertainties of the altitudes and also the errors in reductions through so great altitudes. In this region the altitudes deduced from railroad levelings are few, and even these are not well ascertained. For instance, the altitude of Denver as determined from the Santa Fé and the Denver and Rio Grande Railroad, would be 78 feet higher than the adopted altitude deduced from levelings connecting it with those of the Union Pacific Rulroad. The adopted value is probably the more correct one, but the difference between the two indicates that there is considerable uncertainty in either. But half or more of the altitudes through the high plateau region, marked B in Table I, have been determined barometrically merely by adopting such altitudes as would make the reduced sea-level pressures for the mean of the year harmonize best with those of the nearest stations around whose altitudes had been determined by railroad levelings. Although this smooths off the results, yet the whole system depends upon an inconsiderable number of stations with altitudes well determined. The reduction tables, therefore, for all this region must be regarded as preliminary and approximate only until there are more stations with well de-

termined altitudes.

From an examination of Chart IV it is seen that there are two regions of high pressure, the one in the SE, near the Atlantic, and the other in Oregon and Washington Territory. The former is an extension of the permanent area of high pressure in the Atlantic Ocean about the parallel of 30° or 35°, extending to the coast and somewhat into the interior of the United States, but leveled down in the Mississippi Valley by the deflection of the westerly current of the trade wind by the Rocky Mountain range up this valley and around into the prevailing easterly current of the higher latitude. By the well-known deflection of this current to the right, depending upon the earth's rotation, there must be a gradient of decreasing pressure from the central part of high pressure in all directions, SW., W., and NW., as indicated by the chart. The high pressure in Oregon and Washington Territory no doubt arises from the obstruction of the Rocky

Mountain range to the general easterly motion of the atmosphere in those latitudes. Hence between these two high areas there is a sort of trough of lower pressure extending from the Gulf of Mexico up to the higher latitudes and connecting with the lower pressure of those latitudes prevailing generally all around the globe. Upon the whole, therefore, the tables give apparently a consistent chart of mean annual sea-level isobars, somewhat such at least as must exist, from what we know of the atmospheric currents and

their consequent modification of atmospheric pressures.

The normal monthly averages of the temperature for January and July, reduced to sea level by the same law as in the case of the normal annual averages, are given in Charts Those for January are somewhat irregular for some of the higher stations, especially on the eastern side of the Rocky Mountains, where the temperatures are mostly too low to correspond with the isotherms based mostly upon observed temperatures of stations of lower altitudes. This, as in the case of the annual means, is due to the feehn effect of the strong westerly winds of this season, dropping down to much lower levels after passing the summit of the Rocky Mountains. It is well known that all along the eastern base of this region, extending some distance eastward, there is a belt in winter of much higher temperature than that farther east on the same latitude, even at much lower altitudes. This effect even causes an inversion of the rate of decrease of temperature with increase of altitude, making it increase instead of decrease, if we compare Denver, Cheyenne, Deadwood, &c., with North Platte and other places farther east on nearly the same latitudes.

In comparing open-air observations, as those of a balloon or a mountain peak, with those of a plane near sea level, the rate of decrease of temperature with increase of altitude is found to be greater in summer than in winter, but where the upper station is on a high plateau there is probably little difference. The reductions of the normal pressures for January and July were, therefore, first computed with the monthly normals of temperature at the upper station, and with this, reduced to sea level by the same rule, as the temperature below. But in comparing the normal reduced pressures for January and July it was found that pretty uniformly all over the United States in the Mississippi and Missouri Valley, and also along the Pacific coast, and at all places where the altitudes of the stations were not very great, the difference of pressure between January and July was only about 0.15 of an inch, while for all the high plateau stations they ranged mostly from 0.3 to 0.4 of an inch. It was therefore evident that these greater differences for the high plateau stations arose from using too low temperatures in the reductions of January and too high ones in those of July, for those of the open-air temperatures, which, we have seen, are rather the ones required in reductions to sea level. winter it is well known that the surface of the earth, whether of a high plateau or of a low plane, is lower than that of the open air at only a moderate elevation above, and that the reverse of this is true in summer. For this reason all the reduced pressures, using the observed temperatures at or near the surface, for all the high stations, were too great in January and too small in July, and hence the differences too great. It was therefore necessary to apply some corrections to the reductions for the extremes of January and July, and this correction was determined upon the principle that the differences of the reduced pressures of the high stations for January and July should not be greater, on the average, than those of the low-level stations.

Since in January the observed temperatures are too low, and in July too high, to be used as open-air temperatures, it is reasonable to assume that they differ from the openair temperatures in proportion to the deviation of the observed temperature above or below the annual mean. The error in reduction to sea level is sensibly proportional to the error in the temperature used in computing this reduction. It is also in proportion

to the altitude of the station. Hence, putting

A = the departure of the temperature from the normal annual temperature,

H = the altitude of the station,

c = the average departure of pressure at sea level from the normal annual pressure, a = the observed departure of pressure reduced to sea level, the correction of a for error of temperature used in the reduction must be as the product of A into H, and hence we must have a = c + C A H, in which c and C are constants to be determined from observations of a and A at a number of high and contiguous low stations, by the method of least squares. For this purpose the values of A and a obtained from the normals of January and July can be used. The following table contains these for the principal plateau, and all the adjacent lower stations in the Mississippi and Missouri Valley and on the Pacific coast, contained in the five-year normals already referred to. With these values of A and a, and the values of H, the preceding equation gives an equation of condition for each station from which to determine, by the method of least squares, the most probable values of c and C. We thus get c = 0.073 and C = 0.00105, if we express H in thousands of feet as a unit, and hence we get CA H=0.00105 A H as the correction of the reduction to sea level for the error arising from using erroneous temperatures where they differ from the annual normal, for by the principle above a differs from c only on account of errors of temperature used in the reduction, and these are supposed to vanish for the annual normal, in which case A = o.

TABLE.

Station.	H.	1.	a.	Res.	Station.	H.	<b>A</b> .	a.	Res.
	Feet.	•	Inch.	Inch.		Feet.	0	Inches.	Inch.
Bennett	1,510	30	0.162	+.042	Lewiston	780	22	0.070	021
Benton	2,660	29	. 202	+.047	Little Rock	288	22	.063	013
Bismarck	1,694	32	.130	.000	Los Angeles	339	8	.071	003
Buford	1.854	80	.198	+.064	Memphis		20	.063	010
Cairo	359	22	.072	009	North Platte	2.841	25	.145	003
Cape Mendocino	637	4	. 132	+.056	Omaha	1, 113	27	102	00:
Cheyenne	6,1(5	21	. 157	050	Prescott	5,389	20	. 191	+.00
Concho		19	.112	+.001	Roseburg		13	.057	02
Custer	3,040	26	.148	008	Saint Louis	571	23	.078	009
Davenport		26	.082	008	Saint Paul	831	23	.085	01:
Dayton	1,683	19	.126	+.019	Salt Lake City	4, 348	23	.241	+.06
Deadwood	4,600	21	.123	052	Santa Fé		20	.216	<b>—</b> .00
Denver	5, 294	22	.163	-, 028	Shaw, Fort	3,530	24	.179	+.01
Des Moines	849	26	.095	001	Shreveport	227	18	.052	02
Dodge City	2,517	25	.133	006	San Francisco	60	30	.093	+.020
Elliott	2,700	26	.107	038	Sacramento	64	82	.138	+.06
El Paso	3,764	18	.140	003	Portland, Oreg	80	33	.024	05
tielena	4,069	25	.188	+.008	Spokane Falls	1,906	22	. 134	+.01
Huron, Dak		80	.126	+.012	Stockton		18	.134	+.00
Keokuk	618	26	.080	010	Vicksburg		17	.050	02
La Crosse	725	27	.090	014	W. Las Animas	3,899	27	. 191	+.008
Leavenworth		25	.090	005					,

With the constants above the preceding equation is satisfied for each of the stations with the given residuals. It is seen that some of these are somewhat large both for the low and the high stations, amounting in a few cases to more than a half-tenth of an inch of pressure. This arises in part from errors in the principle adopted, which must be regarded as being only approximate, and in part from abnormal local differences in the values of a, which are considerable also in the nearly sea-level stations where there is little reduction to sea-level, and where consequently these differences can not be due to errors in these reductions. By the correction term in the preceding equation the reductions and the sea-level pressures are increased for temperatures above the annual normal and decreased for all temperatures below this normal, and for the plateau stations it makes the annual range of reduced pressures somewhat the same, on the average, as at the nearly sea-level stations. This correction, containing H as a factor, is of course small for most of the stations, and only becomes considerable for high stations, and especially so for those of large temperature ranges, or values of A, whether of annual or abnormal changes.

Table I contains the reductions to sea-level and standard gravity for each of the stations of the Signal Service corresponding to the approximate annual normal denoted by  $B_0$  and given in the table. The reduction corresponding to the annual normal temperature of each station has been computed by means of the usual formula, using the annual normal temperature at the upper station, and this increased at the rate of 1° for each 600 feet of altitude for the sea-level temperature. For the reductions of diurnal averages of pressure in which the diurnal average temperature is greater or less than the annual normal, the reductions have been computed in the same manner, but afterward corrected by the term  $0.00105\,AH$ , as has been explained. The table is so arranged that the diurnal mean temperature of the upper station must be used as an argument, but it must be understood that the reductions are not precisely those given by the formula with this temperature above, and this increased at the adopted rate for sea-level, except for the annual normal temperature, but this reduction with the preceding correction applied.

As a correction to the reduction has to be applied for annual ranges of temperature above or below the annual mean, so in the case of the reductions of individual observations, subject to diurnal changes, a similar correction has to be applied for all temperatures above or below the diurnal mean, and the latter has to be much greater in proportion to the amount of temperature deviations from the mean, for the periods of the diurnal oscillation of temperature are much shorter, and consequently the temperature changes of the open air cannot follow those of the earth's surface nearly so closely as in case of the annual changes. The diurnal changes in the open air, in general, are perhaps not more than about one-fourth of what they are at the earth's surface. That

dirunal changes of temperature have but little real effect upon reductions to sea-level is evident from the fact that in barometric hypsometry, only very small ranges of temperature between morning and the warmest part of the day are required to obtain from observation the same altitude as when the observations are made at the mean temperature of the day.

In reductions to sea-level, also, we introduce, for high stations, a large diurnal inequality into the reduced pressures, if we use the extreme temperatures of the day in clear weather, whereas observation shows that these diurnal changes are very small at or near sea-level. As in the case of the annual, so in the diurnal ranges of the temperature; therefore, a correction must be applied for extreme temperatures, and in the latter case this has been done here approximately, in the regular tri-daily observations of the stations, by using as the temperature argument, not the observed temperature of the hour, but the mean of double the current observation of temperature, and the sum of the two preceding ones. By this arrangement only about one-fourth part of the effect of the extreme diurnal range is taken in, and this reduces the diurnal range for the high stations to about what is usually observed at and near sea-level.

Table II, with arguments  $B_0$  and  $\Delta B$ , contains the usual correction for variation of pressure at the station. This, it is seen, is small for low stations, but for high stations and unusual variations of pressure it becomes a very important correction. It has been computed from the formula—

$$Correction = \left(\frac{B_o'}{B_o} - 1\right) \Delta B$$

in which  $B_{\rm o}'$ , being the value of  $B_{\rm o}$  at sea-level, has been assumed for all stations to be equal to 30 inches. This, it is seen from Chart III, is very nearly the case, especially for all the high stations in the west, where alone a small error can have any sensible effect.

By means of these two tables the monthly normals for January and July have been reduced to sea-level, using the corresponding normals of temperature as arguments. The results are given in Charts V and VI. By comparing these charts it is seen that the difference of pressure between January and July is on the average and pretty uniformly, about 0.15 of an inch, whereas if the correction for the extreme temperatures of January and July had not been applied, the differences for the high stations would have been generally much more.

The expanded tables which have been furnished, one to each station, have been formed by taking the part of Table I belonging to each station and applying to it the proper correction from Table II. In this way tables were obtained, one only for each station, with the observed temperature and pressure of the station as arguments from which the proper reductions can be taken with little or no interpolation even in case of the highest stations.

Reduction of barometric pressure to sea-level and to standard gravity.

### USE OF THE TABLES.

The first reduction is obtained from Table I, with one-fourth of twice the last and the two preceding tri-daily temperature observations of the station as an argument. To this add or subtract, as the case may be, the second reduction obtained from Table II, with  $\Delta B$  and  $B_0$  as arguments. This sum or difference is the complete reduction to be added to the observed pressure at the station.

If  $\Delta B$  is positive; that is, if the observed barometric pressure is greater than the mean  $B_0$  then the second reduction from Table II is additive, but otherwise it is subtractive. The values of  $B_0$  are given in Table I, opposite the names of the stations.

REDUCTION OF BAROMETRIC PRESCURE TO SKA-LEVEL AND STANDARD GRAVITY.

TABLE I.—Argument; the mean of twice the last and of the two preceding tri-daily temperature observations.

		=				ř	Temperature argument.	ure arg	rument					l
Stations.	ż	≓	8	07-	0	01	8	8	3	8	8	8	8	8
Abilene Albany Alpena Apache	15 15 15 15 15 15 15 15 15 15 15 15 15 1	Feet. 1744 83 609 5020 B	00 02 02	0.10	2.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0	00.0 82.58	20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00 20.00	2000 2000 2000 2000 2000 2000 2000 200	20.00 20.00 20.00 20.00	1.34 8888	-:0.0.4 8.883	1.0.0.4. \$88.8	-:004 1328	1.00.4 2.30.35
Assinabolne. Atlanta. Atlantic City. Augusta. Baltimore	23833 20000	2690 B 1129 13 183 45	8. 10	8.08	8.1.0.0.0 88.00.00 84.00.00	82828 22828	21.00.0 21.00.0	0.00 0.00 0.00 0.00 0.00	2.1.0 0.00 0.17 0.03	2.1.0 0.0 0.17 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	9.1.0.0.0 9.1.0.0.0 9.1.0.0.0 9.1.0.0.0	0.0017 0.0017 0.008	0.00 0.00 0.00 0.00	21.12 0.00.00 0.15 0.15
Barnegat Behring's Island Bennett Benton Bismarck	888228 808228 800488	20 1510 2060 B 1084	0.06 3.07 2.00	0.1.2.1. 35.22.72	19190	00-14-1 28899	00191 0888 8	0.0.1.9.1 0.8.2.8.8 0.8.2.8.8	0.01.21. 28.88.2	0.01 0.03 1.2.06 1.2.08 1.3.08	183868	0.0 1.9.1.9 1.78 1.78 1.78	00-14-1 28858	0.00 0.04 1.65 1.74 1.74
Bioek Island Bidwell, Fort. Boisk (Ity. Boston Bridger, Fort.	887.88 04460	27 4615 2750 B 125 125 6643	0.02 3.08 7.14 7.12	0.02 5.01 7.01 7.01	04.00 <b>.0</b> 23.84.3	6.14.0 6.14.0 70.00 70.00 70.00	0.4.9.0.0 85.85.8	0.49.0.0 26.22.09	0.24.0 0.25.00 5.13.00 5.13.00	0.4.9.0.0 0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0	0.440.0 282228	0.4400 858538	6.2.4.0 2.1.3.4.5 2.1.3.4.5	0.4.2.0 0.0.4.2 0.1.3.4.2 1.1.3.4.2
Brownsville. Buffalo Buffalo Bufford. Cairo Canby, Fort.	0.83.83.83 0.83.04.83 0.83.04.83	55 690 84 B 856 179	0.81 2.19 0.22	0.30 0.22 22.23	00400 25289	0.20 0.78 0.39 0.21 0.21	00000 00000	0.0000	00000 00000 00000	0.01.00	0.1.0 0.36 0.36	0.1.0.0	0.1.0.0 0.32 0.19 0.19	0.01 0.71 0.35 0.35
Cape Henry	0.08 82 80.09 0.04 0.00	ន្តមន្តិនេះ			82533	88758	8288	82383 	85883	82888 00000	82228	82528	82888 	82828
Charlotte Chattanooga (heyenne	882	808 783 6105	<b>3</b> 9	6.56	0.89 6.83	888	20.00	888 2	888	0.9 0.8 9.9 9.9	88.88 88.88	0.08 7.08 7.09 7.09	0.8 0.78 86.78	5.0.8 8.78

REDUCTION OF BAROMETRIC PRESSURE TO SEA-LEVEL AND STANDARD GRAVITY-ContinueJ.

			1	i	i I	Te	mperat	Temperature argument	ment.					
Station s.	 ชื่	Ħ.	8	-10	9	or	8	8	\$ 	8	8	<u>ا</u> و	· 38	, , ,
Chicago	Inches. 23.3 30.0	F26.	0.78	0.7	, %2 %2	0.0 10.00	6. 0. 2. 2. 13	0.73	6.0	0.0 1.0 1.0	6.9 6.3	86 60	0.0 0.0 10	0.68 0.01
Cincipuati Cleveland. Columbus.	8,9,8 4.0.6	8 <del>8 2</del>	18.0	98.	0.0.0 15.0.0	0.00 0.82	0.00	9,00 8,58	0.0.0 Pt. 2	0.00 8.42 8.43 9.43 9.43 9.43 9.43 9.43 9.43 9.43 9	858	873	25.0 25.0 25.0 25.0 25.0 25.0 25.0 25.0	0.0.0 8.1.3
Concordia.	รู้ สู่สู่	1384 3010B	3.47	3.42	35.55 35.35	2.83 28.93	8.58 8.83	3.25	3.35 3.25	3.16	3.12	3.08	3.4	
Davenport Davis, Fort Davison Dayton Daywood Delaware Brenkwater	ุ รากต o สำสัสล์	615 4928 B 1645 B 1645 B	0.72 1.91 5.16	0.71 1.91 5.08	0.00 0.00 0.00 0.00 0.00	0.03.1.0 0.03.13.00 0.03.21.00	0.7.1.4.0 88.8.2.2 2.2.2.2	0.41.40 0.42.861 0.00	83F32	83832	84.149 85239	25232 25232	23332	0.4:14:0 8:28:89
Denver Des Molites Detroit Dodge City	44444 1-1040	5294 849 8517 865	00000 28288	18143	00000 00000	83656	0.05.40 0.23 0.74 0.74 0.74	22222	82737 7867 7867 7867 7867	28782	20.0.40 25.32 25.32	54888 01000	82828	40040 28828
Duluth Eastport. Elliout, Fort. El Puso.	887288 80842	672 61 2700 B 3764 B	0.81 0.80	0.80	00440 52884	00000 18893	38351	00.4.8.0. 57.88.55 75.55	58885 28853	00.480 47.575 77.575	22235	28252	25483	0.0.26.00
Ecanaba Fort shith Prort shith Priseco Galveeton Grand Haven	ដូម្មីដូម្មី ដូច្ចក <b>ុ</b> ចត	86.45 5.55 5.55 5.55 5.55 5.55 5.55 5.55	0.73 0.73	0.72 6.75 0.72	0.06.00 0.00 0.00 0.00 0.00	66.00 84.20 80.24.3	0.06 0.05 0.01 0.09	00.00.0 0.00.00 0.00.00 0.00.00	52832	0.65 6.05 6.06 6.06 6.06	8588	84388	24288	84882
Grant, Fort. Greencastle Hattern, Mont. Huron	*******	10:0 B	5.1.	1. 32	85258 82258	89.04.1 89.08.8 4.4	0.000.4.1 0.8.08.5 0.8.08.5	4004- 92022	20041 2003 2033	#30541 #3255	4004-	8202E	4.0.04.1 2.2.0.8 1.88	4.0.6.9. 8.0.9.8 8.0.9.8

Indianapolia. Indianola Jacksonville Keeler Keekuk	88883 80144	200 200 200 200 818	3, 11		000000 200000	50000 50000	200.000 200.000 100.0000	0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.	830080	00000 00000	82288 00000	\$228 <b>2</b>	62082 -	00000 20023	
Key West. Kitty Hawk Knoxville La Crosse. Lamar, Mo.	888888 6======	82382	0.85 1.80	0.81	60-10-1 82183	60494 85834	6.0.1.0.1 8.0.0.2.1 1.1.2.2.2.1	0.0.0.0.1 1.38811	82253 82253	8288 8488	34858	82258 64298	82882 84882	00001 84808	
Pike's Peak. Leavenworth Lewison. Little Rook. Look Angeles.	1.8883 7.9983	25.25.28.28.28.28.28.28.28.28.28.28.28.28.28.	13.05 0.95 0.98 1.98	13, 18 0, 95 0, 87	88888 1	90000 88848	6.0.0.0.0 6.0.0.0.0 6.0.0.0.0 6.0.0.0.0 6.0.0.0.0	==000 2000 2000 2000 2000 2000 2000 200	20000 28882	20000 8888 8888	10000 218888 818	00000 8228 8228	0.38 0.278 0.327	88.18 88.18	
Louisville. Lynchurg. Mackinaw City. Macon, Fort.	888888 848-8	652 652 11 665 11 630 13	0.73	0.72	20.0.0.4. 20.7.3.5. 1.20.7.	00004 25532 1	0.0.0.4. 81.88.38 	0,0,0,4, 05,0,0,4, 05,0,0,4,	00004 88283	83888 83888	0000¢4 72889	00004 80888	88282	0.000. <del>1</del> 888888 808	
Marquette Memphis Missukee. Mobile Monigomery	នូងនូងនូង ១৮១-១	25 88 32 2 25 25 25 25 25 25 25 25 25 25 25 25 25 2	0.81	0.80	0.0.0.0.0 0.2.80.2 0.2.80.2	\$2553 \$2553	0.00.00 0.00.00 0.00.00 0.00.00	0,078 0,073 0,073 0,08	0.00 0.32 0.00 0.21	00000 48832	00000 E2E88	0.0.072	0.0.0 0.03 0.03 0.03	0.00 0.00 0.19	
Montrose Mortlead Montroso Mon	ដូននៃនៅ	62.8 62.8 62.8 567.11	1.13 8.53	6.15	6.00 6.75 0.00 0.00	5.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00	5.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0	50.00 88493	5.69 1.63 0.23 0.57	5.61 1.02 5.97 0.28 0.57	00.51.55 00.22 00.22 00.22 00.22 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.23 00.	0.0.5.24	50.000 58288 58288	28 28 00 00	
New Haven New London New John Orleans New York City Now York City	88888	54228			0.0000	0.0.0.0 1.0.0.0.0 2.0.0.0.0	0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.	0.0.0.0 0.0.00 0.00 0.00	0.000.00.00.00.00.00.00.00.00.00.00.00.	0.000 0.000 0.000 0.000 0.000	00000 00000 0128E0	0.00000	0.0.0.0 0.00.0 0.00.00 0.00.00	0.00 0.00 0.00 0.01 0.01	
North Platte Olympia Obwego Palestine	28.88.88 10.62.53	¥ 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	3.23	3.19	3. 14 0.05 0.39 0.37	00100 00888 00888	8.0.1.0.0 8.8.8.8.8 8.8.8.8.8	0.03 0.03 0.33 0.33	601.09 633858 738858	00-106 231222 231222	00108 008128 008128	0.03 0.36 0.36 0.36	20100 20100 20100 20100	90.1.0.0 0.0.2.2.2 5.3.2.2.2	
Pensacola. Philadelphia. Pittsburg. Popila Liber. Popt Angeles.	852288 10860	2000 H	2.34	2.30	0.0.0.0.0 0.0.0.0.0 0.0.0.0.0.0.0.0.0.0	0.0.00 0.0.00 0.0.00 0.00 0.00 0.00	0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.	0.0.0.0 0.1.0.0.0 0.1.0.0.0 0.1.0.0.0 0.1.0.0.0 0.1.0.0.0	0.0000000000000000000000000000000000000	0.0.0.0.0 21.8828	91888	51888	0.0.0.0.0 0.1520 0.000	0.020 0.020 0.022 0.022	

REDUCTION OF BAROMETRIC PRESSURE TO SEA-LEVEL AND STANDARD GRAVITY-Continued.

	10						Tempe	Temperature argument.	argum	ent.				
Stations.	H.	'n.	-30	-10	0	30	20	30	40	99	99	24,	8	8
Port Huron Portland, Me. Prescott. Red Binff.	Inches. 29.3 30.0 30.0 24.8 29.7	Feet. 633 90 80 6389 B			0,73 0,11 0,10 0,37	0.72 0.10 0.36 0.36	0,71 0,10 5,50 6,36	0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.	0.000.00 0.000.00 0.000.00	0.68	0.000 0.000 0.000 0.000 0.000 0.000	0.67 0.09 0.10 0.33	0.00.00 0.00.00 0.00.00 0.00.00	00.00.0 80.888
Rio Grande City	84.888 9.4808	230 B 621 623 64 64			0,000	0.71 0.59 0.06	0.00 0.00 0.00 0.00	0,0,0,0 0,0,0,0 0,0,0,0,0	0.00 0.05 0.05 0.05	0.0000	99999 88888	0.00 0.05 0.05 0.05 0.05	0.0.0.0 0.00.0 0.00.0 0.00.0 0.00.0 0.00.0	0.0.0.0 0.0.0.0 0.0.0.0 0.0.0.0 0.0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 0.0.
Saint Michaels, Fort. Saint Phul. Saint Vineent. Sain Lake City. San Antonio	81.88.88 81.87.8	8 2 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8	0.09	0.09	0,00 9,00 9,00 9,00 9,00 9,00 9,00 9,00	0.08 0.95 0.95 0.83	0.08 0.93 0.83 0.83	0.000 0.000 0.400 0.400 0.400 0.400	0.08 0.91 0.91 0.80	96.00	0.00 88.00 18.70 87.00	0.08 0.88 0.77 77	0.00 28.00 28.00 67.00 78.00 78.00 78.00	0.00 0.40 0.88 0.17 0.17
San Diego. Sandusky. Sandy Hook Sanford. San Francisco.	88.89.89 8.40.00	28 88 8 8 8 8 8			0,03	0.02	81818	26999	28828	90000	98229	90000	28882	00000 88222
San Louis Obispo Santa Fé Sayamah Sayaw Shreveport	28.88 7.20.88	270 7026 8530 B	4.03	3.96	0,30 7,15 3,90 0,13	0 2 0 2 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0.30.00	0.00.00 0.00.00 0.00.00 0.00.00 0.00.00 0.00.0	0.8.0.8.0 8.5.5.88	0.00 0.00 0.00 0.00 0.00 0.00	0,26 0,55 0,25 0,25 0,25 0,25 0,25 0,25 0,25	0,80,80 9,83,88 8,83,88	0.0000 82.0000 82.00000	0.0.0.0.0 8883
Sill, Port Silda. Smithville. Spotsare Palls. Springüeld, III	28.02 8.02 8.03 8.03 8.03 8.03 8.03	021 22 22 24 24 24 24 24 24 24 24 24 24 24 24 24 24 2	2.24	2,20	0,17	0,20 0,14 0,14 0,14 0,14	0.00 10 0.00 10 0.00 10	02020	0.0000	10099 20099 20098	20040 82698	10.00 0.00 0.00 0.00 0.00	0.00000	
Stanton, Fort. Stockkon Stivkkon Tutomb Island Thomas, Fort.	22.22.22 0.08.02.72 0.08.08.02	6150B 8004B 1600B 86 2710B	.1 88	88.	2.0.2 2.0.2 2.1.3 3.1.3 3.1.3	20.199 21.882 21.882	8.16 1.70 1.87 2.87	2.00 2.00 2.00 3.00 3.00 3.00 3.00 3.00	96.1.3	201.04 882.05	20109 2000 2000 2000 2000	541.04 58638	58388	53283

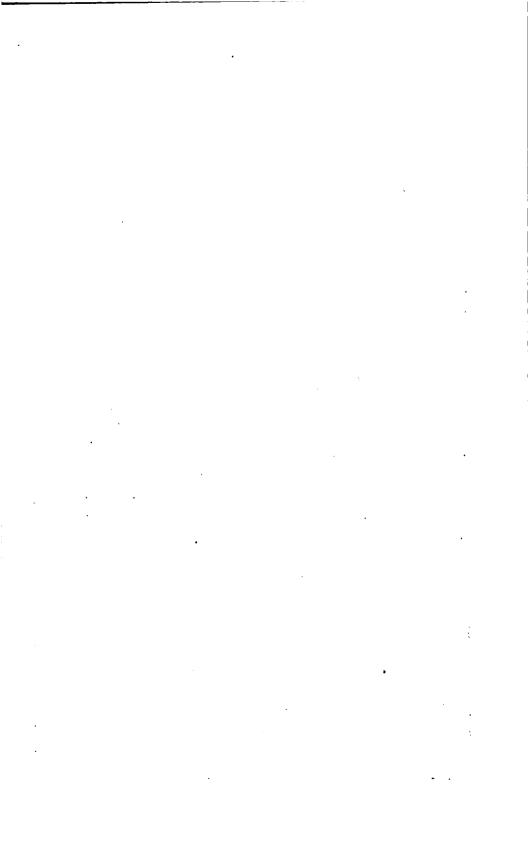
Toledo Fort Tuden Fort Valentine Valentine	20.3 20.8 20.8 1147 20.8 125 20.8 20.8	2. 78	2. 28	0.10.90 0.17.10.00 0.00.00 0.00.00 0.00.00	61046 8128	5-040 2822	62062	0.2.00.00.00.00.00.00.00.00.00.00.00.00.	0.10.10 0.20.20 0.20.21	61272	0-1040 88828	0-1-0-4-0; 85-2-2-8	0.50.00 0.50.00 0.50.00 0.50.00
Washington Well Las Animse Well Las Animse Winnerwoon Winnerwoon	26.0 26.0 26.0 26.0 26.0 26.0 26.0 26.0		4.80 4.73 1.44 1.42	0.4041 12823	1.88.18	04041 E8828	0.4.0.4.1 0.8.8.48	0.8.0.4.1 0.88.88 0.42.88	0.8.0.4.1 0.8.8.8.2 8.8.8.2	0.8.0.4.1 0.8.8.2 0.8.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.1 3.3.	0 8 0 4 1 0 8 8 8 8	0 8 0 4 1 8 8 8 2 8	0804-1 88878
Yund	20.8	1		0.13	0.13	0, 13	0.13	0.12	0.12	0.13	ησ	o'n	= = = = = = = = = = = = = = = = = = =

BEDUCTION OF BAROMETRIC PRESSURE TO SEA-LEVEL AND STANDARD GRAVITY.

TABLE II.—Arguments; B. and AB, in which Bo is the approximate mean pressure at the station, and AB=B-Bo is the difference between this mean and the observed pressure.*

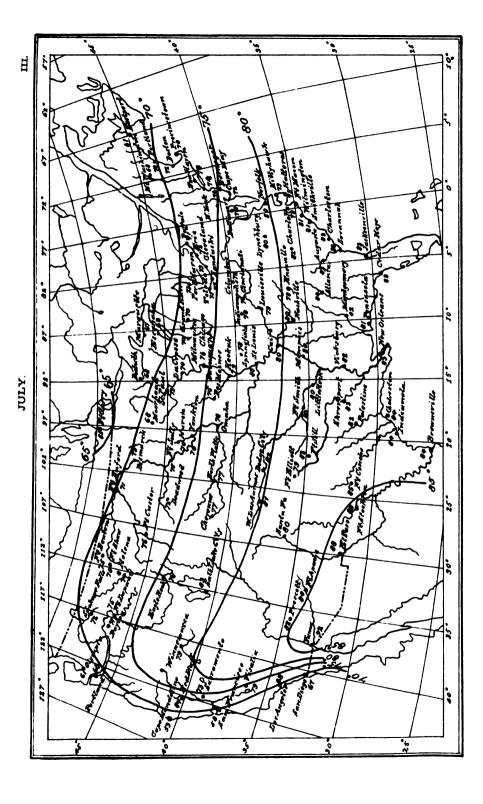
	Pile's Peak. 17.7	0. 0. 0. 11. 14.	22888	8.44.45	55. 68. 69. 60.0
	28.5	28282	861111	21. 18 19 19	ដូននេះ
	24.0	28388	280111	4.5.1. 2.0. 2.0.	82.23.28
	24.6	28898	28831	25555	. 18 . 20 . 20 . 21 . 22
pes.	25.0	98898	82885	1.21.21.21.21.21.21.21.21.21.21.21.21.21	.16 .17 .18 .19 0.20
n Be in inc	25.5	0. 20. 20. 20. 20. 20. 20. 20.	ន់ន់ខ្ន	51112	. 14 . 15 . 16 . 17 . 0.18
the station	26.0	0. 20. 20. 20. 20.	ន់ន់ន់ខំន	8.6.5.1.1.	. 12 . 13 . 14 . 15 0.15
pressure of	26.5	2222	28882	58883	. 11 . 12 . 13 . 13 . 13
Mean barometric pressure of the station Be in inches.	27.0	9.2828	ន់ទន់ន	82288	
Mean b	27.5	6.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0	<u> इंडंबंबंबं</u>	ន់ន់ន់ន់	9.88.99
	28.0	82228	នន់ន់ន	ន្ទន់ខ្ទុ	.08 .09 .09
	28.5	88999	នន់នន	<u> इंडडंड</u>	99888
	280	88822	9999	ន់ន់ន់ន់ន	នន់ន់ន់ន្
	29.5	88888	<u> ಪ್ರಪತ್ತ</u>	<u> </u>	9.9.9.9
VB.	ij	4. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0.	<b>अंधं</b> इंदे	33855	8.8.8.8.8

* Barometer reading corrected for temperature and instrumental error, but not reduced to standard gravity.



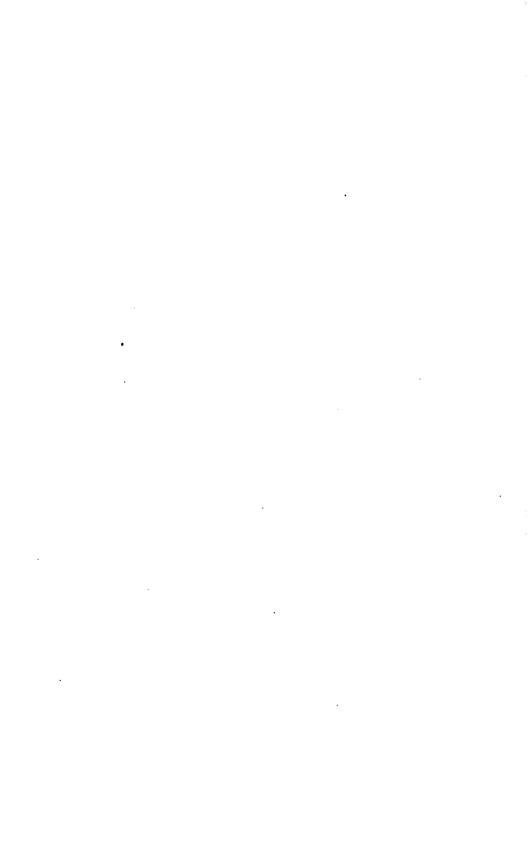
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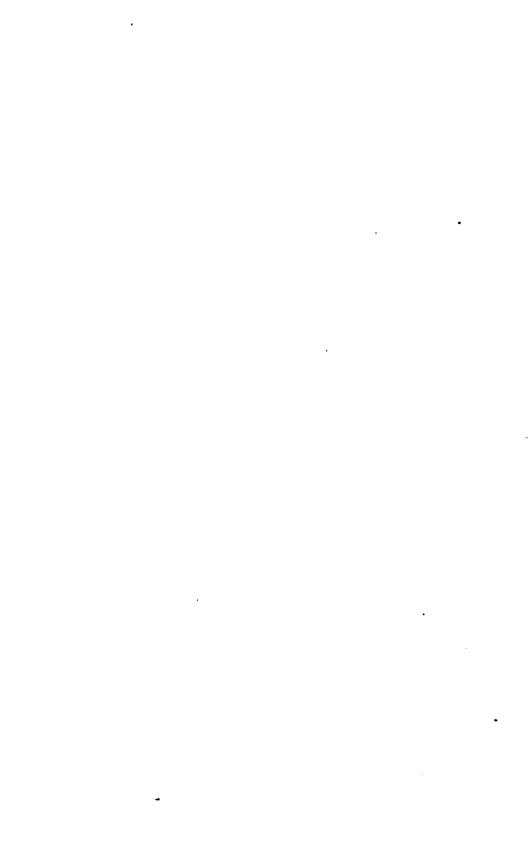




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### APPENDIX 24.

REPORT OF PROFESSOR WILLIAM FERREL, ASSISTANT, ON PSYCHROMET-RIC TABLES FOR USE IN THE SIGNAL SERVICE.

> SIGNAL SERVICE OFFICE, Washington, December 10, 1885.

SIR: I have the honor to transmit herewith a report upon the work assigned me of adapting the psychrometric formula to the whirled psychrometer and of preparing psychrometric tables based upon it for the use of the Signal Service. To this end I was instructed to use the experiments made in Colorado by Junior Professor Marvin especially for this purpose, and also to discuss, and utilize as far as possible, observations made elsewhere. In the determination of the constant in the new adaptation of the formula only such experiments could be used to advantage as had been made in accordance with the proposed new manner of using the psychrometer; and the unexpectedly large number of experiments in Colorado on account of delays in ascending to Pike's Peak rendered it entirely unnecessary to seek others, except for the sake of having a greater weight of experiments at and near sea-level, where psychrometric tables are mostly used. In addition, therefore, to the comparative simultaneous experiments made at Washington by Professors Marvin and Hazen, after the return of the former from Colorado, those which had been previously made by the latter in Massachusetts and Washington with a whirled psychrometer have likewise been used.

A partial discussion was made of the experiments made by Pvt. Delano at Yuma, and Sergeant Leitzell at Colorado Springs and Pike's Peak, in 1893, with little or no special ventilation, but the results, as usual where there is but little ventilation, were so discordant, and so different from those obtained from the experiments with the whirled psychrometer, that they were judged to have no weight in comparison with that of the very satisfactory results obtained throughout from the experiments with the whirled psychro-

meter.

I am, very respectfully, yours,

WILLIAM FERREL,

Professor and Assistant.

The CHIEF SIGNAL OFFICER OF THE ARMY.

REPORT ON VAPOR TENSION, DEW-POINT, AND RELATIVE HUMIDITY TABLES.

1. The psychrometric formula, which is required to be reduced to tables, may be expressed in the following general form:

$$(1) p = p_1 - A P(\tau - \tau_1)$$

in which-

r = the air temperature;

 $\tau_1$  = the temperature of the wet-bulb thermometer;

p = the tension of aqueous vapor in the air;

 $p_1$  = the tension of saturation at temperature  $r_1$ ;

P = the barometric pressure;

A = s function which is a constant, independent of the vapor tension, only under certain fixed conditions.

This formula has been deduced by both Maxwell* and Stefan† upon the principles of the interdiffusion of gases, and has been further considered theoretically by the present writer, ‡ to which treatises reference must be made for the theory of the formula, since it is not convenient to introduce any theoretical researches here.

Recent Advancements in Meteorology.

^{*}Encyclopedia Britannica, ninth edition, article Diffusion.

[†]Teit. der Oest. Gesell. für Meteorologie, XVI, p. 177.

The value of A above, except so far as it depends in a very small measure upon  $r_1$ , has usually been regarded as a constant under all conditions of ventilation, size, and shape of the wet bulb, thickness of stem, &c. In order for this to be the case, it would be necessary for  $r-r_1$ , the amount of cooling of the wet bulb by evaporation, to be the same under all these conditions; but it has been long known, and can be readily shown

by the most casual and crude experiments, that this is not so.

More than a half century ago Belli, * a distinguished Italian physicist, showed by experiment that the amount of cooling of the wet-bulb thermometer by evaporation depends both upon the amount of agitation of the air and upon the size and shape of the bulb. His experiments showed that in passing from tranquil air to that having a motion of a few meters per second, there was a considerable depression of the temperature of the wet bulb, and that in the passage from tranquil air to that having a velocity of one meter per second the effect was very much more than in the passage from air with a velocity of one meter per second to that with a velocity of three meters per second, and that with an increase of velocity beyond three meters per second there was scarcely any further depression of the temperature. He also found that the smaller the bulb, whatever its shape, the greater was the depression of temperature for any given velocity of ventilation, but that the differences of temperature depending upon size and shape gradually diminished with increase of ventilation, and vanished with that velocity which gives sensibly the maximum depression of temperature.

(2.) Since the value of  $\tau - \tau_1$  therefore depends upon both the size and shape of the bulb and the amount of agitation of the air, it was evident that the indications of the psychrometer under all conditions could not be used for determining from the psychrometric formula the hygrometric state of the air, unless they were always taken with some given size and shape of bulb and velocity of ventilation, or else with that velocity of ventilation which gives the maximum depression of temperature of the wet bulb, in which case the differences depending upon size and shape vanish. Belli, therefore, recommended the use of a ventilated psychrometer, and he was the first to do so, and he also devised an apparatus by which a current of air could be drawn through a tube, first over the dry, and then over the wet bulb by means of the reverse action of a bellows.

over the dry, and then over the wet bulb by means of the reverse action of a bellows. It is well known that Espy, also, in his psychrometric observations, always used a sling psychrometer. His language is: "When experimenting to ascertain the dew-point by means of the wet bulb I always swung both thermometers moderately in the air, having first ascertained that a moderate movement produced the same depression as a rapid one." From the indications obtained in this manner he obtained, by means of an empiric formula devised for the purpose, the hygrometric state of the air. Although his formula was imperfect, and not applicable with much accuracy to either extreme of temperature, yet for a large range of medium temperatures it gave, in general, much better results than Regnault's formula, with the value of A usually adopted, where the psychrometer is not used under the conditions of velocity of ventilation, size and shape of the bulb, &c., to which the value of the constant is adapted, but under any conditions existing at the time.

(3) Although so long a time has now elapsed since these initial attempts to introduce the use of the whirled or ventilated psychrometer, yet meteorologists of the present time are just beginning to see the importance of adopting the principles and methods of these two distinguished pioneers in true psychrometry. This arises from the fact that recently many comparisons of results given by the ventilated or whirled psychometer with those given by the ordinary use of the psychrometer, and also of those given by the latter with the indications of the condensing and other hygrometers, have been made, and the great differences noted. From these it is evident that the psychrometer, as it has been used, is very imperfect, so much so that Dr. Assman, of Magdeburg, Germany, has recently stated, and justly, that "it is the most uncertain of all meterological instruments."

This is fully confirmed by a comparison of vapor tensions given by the psychrometer and condensing hygrometer in experiments recently made in connection with the Signal Service. The following table contains the vapor tensions obtained by Langley † at Lone Pine Station, Arizona, in his Mount Whitney expedition, with the psychrometer and Guyot's Tables and Regnault's condensing hygrometer:

^{*}Corso elementare di Fisica Sperimentale di Giuseppe Belli, Professor di Fisica nell, I. R. Liceo di Porte Nuovo in Milano, 1830.

[†] Mount Whitney expedition.

			Force of	vapor.
Date.	Local time.	Wind.	Psychrom- eter.	Hygrom- eter.
August 8. August 8. August 9. August 10. August 11. August 12. August 12. August 13. August 14.	h. m. 8 15 a. m. 8 15 p. m. 8 15 p. m. 8 15 p. m. 8 15 p. m. 8 15 a. m. 8 15 a. m. 8 15 a. m.	Gentle. Fresh. Calm. Fresh. Gentle. Fresh. Gentle. Fresh. Gentle.	mm. 16.18 10.89 16.65 10.06 11.61 6.52 12.20 12.10 13.00 9.98	9. 72 8. 87 11. 70 8. 87 7. 08 5. 84 7. 39 8. 23 7. 49 8. 08
August 14.	8 15 p. m.	Variable.	5.04 11.30	5.51 8.07

In every case except one the psychrometer gave a vapor tension too great, and on the average it gave one which is nearly one-half too great.

The following is a comparison of vapor tensions given by the psychrometer with Guyot's tables and Alluard's condensing hygrometer, in the experiments made by Private Stuart M. Leitzell, of the Signal Service, at Colorado Springs, during the latter part of August, in the series made alternately at Colorado Springs and on Pike's Peak during the year 1883. Also in the case of similar experiments made by W. S. Delano at Yuma, Ariz.,

during the same year:

Leitz	zell.				Dela	no.		
	Val	or tensi	ons.			Val	por tensi	ons.
Date.	Psychrom- eter.	Hygrom- eter.	Р-Н.		Date.	Psychrom- eter.	Hygrom- eter.	Р—Н.
Aug. 19	mm. 8,07 8,49	mm. 6.20 6.97	mm. 1.87 1.52	Sept	. 25	mm. 7.77 10.03	mm. 7.78 8.96	mm. 0.01 +1.07
20	9.55 9.08	6.97 5.58	2.58 8.50		26	6.31 8.23	5.50 5.12	+0.81 +3.11
21	8,62 7.51	5.46 4.41	8.16 8.10		27	7.83 9.06	6.74	+1.09
<b>23</b>	8.84 9.10	6.60 7.42	1.65		28	11.67 6.00	11.58	+0.09
23	8.63 9.12	7.36 6.37	1.27 2.75		29	10.71 7.95	9.64 6.69	+1.07
<b>4</b>	11.62 10.83	10.16 7.12	1.46 3.71		80	12, 94 13, 17	12, 12 12, 12	+0.82
<b>55</b>	8. 44 9. 31	6.92 7.42	1.52	Oct.	1	9. 42 9. 20	8.78 8.05	+0.64 -1.15
26	11.18 12.43	11.14 11.43	0. <b>04</b> 1. <b>00</b>		}2	8. 12 7. 14	6. 64 5. 66	+1.48 +1.48
<b>27</b>	12.86 8.65	10.85 6.83	2.01 2.82		8	5.98 4.54	5.86 4.41	+0.10
28	12.41 11.44	10. 92 8. 66	1.49 2.78		4	9.86 11.30	10.16 9.20	-0.30 +2.10
29	10.63 8.50	7.36 5.46	3. 27 3. 04		5	5.02 2.69	4.67 8.28	+0.33 -0.59
<b>3</b> 0	10.71 11.17	8.05 7.17	2.63 4.00		6	4. 33 3. 86	4.80	-0.47 -0.45
81	10.34 7.96	7.31 4.16	3, 03 8, 80		7	7. 24 5. 48	7. 26 6. 24	-0.02 -0.76
Means	9.80	7.45	2, 35		Means	7.92	7.12	+0.80

In the case of Leitzell's experiments the psychrometer again, with Guyot's tables, gives a vapor tension too large in every case, and in the average of the twenty-six experiments, one which is about one-third too large. In Delano's experiments the differ-

ences in individual cases are often quite large, but in the average the difference is very much smaller.

(4) It is not to be supposed that these large differences in the preceding comparisons are due to inaccuracies in the experiments. They arise simply from the use of the psychrometer under conditions to which the constant in Regnault's formula and Guyot's tables based upon it are not applicable, for to obtain true results in the ordinary use of the psychrometer it would be necessary to have a different constant in the formula and a different set of tables for every change of breeze.

In the case of Langley's experiments there seems to have been but little wind, perhaps nearly a calm, where the thermometers were exposed. Leitzell and Delano were instructed to fan the thermometers when the velocity of the wind was less than 10 miles per hour. The fanning of the former does not seem to have had much effect, since there is generally not much difference in the depression of the wet-bulb when fanned and unfanned, the readings for both being given. Hence the differences between the psychrometer and hygrometer are large, nearly as much so as in the case of Langley's unfanned psychrometer. Delano seems to have fanned more effectually, as appears in the greater differences between the readings of the wet-bulb thermometer when fanned and when not fanned; and hence there is, in general, a better agreement of his psychrometer with the hygrometer. If the thermometer had not been fanned at all the differences in the preceding table between the psychrometer and nygrometer would, in general, have been considerably greater. It is safe to state, therefore, that vapor tensions, as usually obtained with the psychrometer in close shelters without special ventilation, are, on the average, at least one-third too great.

(5) That the same constant in the psychrometric formula and the same tables cannot be used with the psychrometer under all conditions is well shown by the recent very important researches on this subject by Sworykin, of St. Petersburg, Russia. Putting the formula into the form of the preceding equation (1), he has shown by careful experiments that the values of A required to satisfy the equation when the psychrometer is used with different velocities of ventilation and with two different kinds of thermometer bulbs, are as given in the following table, in which the numerical values of A are read from curves in the graphic representation of his results:

	Values of A for	a psychrometer.
Velocity of ven- tilation in me- ters per sec- ond.	With spherical bulbs 10 mm in diameter.	With cylindrical bulbs 8mm in length and 4mm in diameter.
0, 2	0.001120	0.000900
0.4	920	775
0,6	845	730
0.8	800	710
1.0	774	697
2.0	712	670
8.0	687	660
4.0	673	655
5,0	664	652
6.0	656	650

From these results it is seen that the value of A is large for a small velocity of ventilation, and that there is a very great change in its value, while large, with a small change of velocity of ventilation, the change in passing from almost a calm to a velocity of one meter per second being very much greater than that in passing from a velocity of one meter per second to one of three meters per second. From an inspection of the formula it is seen that a large decrease in the value of A must correspond with a large increase in the value of  $r_{-r_1}$ , that is, in the depression of the wet-bulb temperature. Hence the experiments of Belli and of Espy, who found that the amount of depression of the wet bulb at first increased very rapidly with increase of velocity of ventilation, but that there was but little increase after a velocity of three meters per second had been attained, are confirmed by these of Sworykin, in which the value of A changes rapidly at first with increase of ventilation, but after a velocity of three or four meters there is but little further change in its value.

Belli also found that the depression of the wet-bulb temperature for the same velocity of ventilation, when small, was greater for small than for large thermometer bulbs, and an accordance with this, S very kin likewise finds a smaller value of A for a small cylin-

drical bulb than for a larger spherical one. The former also found that with a velocity of three meters per second there was no sensible difference between the temperature depressions of large and small bulbs, and so in the preceding tabular values of A it is seen that there is likewise little difference in the values required, with velocities greater

than three meters per second.

No one familiar with the subject can merely glance at the results in the preceding table of Sworykin's results without seeing the futility of attempting to use the same tables either with the same psychrometer used with different velocities of ventilation, or psychrometers with thermometer bulbs of different sizes and shapes, used with the same velocity of ventilation, unless this velocity in both cases is at least three meters per second; and it is: from these, perhaps, more than from any others, that meteorologists are now beginning to see the necessity of adopting the sling or whirled psychrometer.

With any given shape and size of thermometer bulb, largeness of stem, and velocity of ventilation, a constant in the psychrometer formula would be determined and tables constructed to correspond, but it is seen that, unless the velocity is large this would always require the same kind of bulb and the same velocity, and the latter to be accurately measured. But by using a large velocity of ventilation, three meters or more per second, the same tables can be adapted to any kind of a thermometer and to all changes of velocity above that which gives sensibly the greatest depression of the wet-bulb temperature; and with this arrangement there is no necessity to measure or estimate the velocity in each case, but we have only to be certain that it does not fall below a given limit.

(6) From what precedes, therefore, it would seem that the determination to introduce into the Signal Service the use of the whirled psychrometer and to have it whirled with a velocity of three or more meters per second and to prepare tables adapted to such a use of it is a wise one. The preparation of such tables required the previous determination of the constant A in the psychrometric formula adapted to the new method of using the psychrometer, and this, of course, could only be determined from experiments made

with the psychrometer used in this manner.

Few experiments had ever been made, and none at very high altitudes, to determine whether the same value of the constant A, in the ordinary use of the psychrometer, held at all altitudes; and these, it is well known, have given unsatisfactory results. It was, therefore, very properly decided to have the experiments for this new determination of the constant made at several very different altitudes, ranging from sea-level up to the

top of Pike's Peak.

From the simultaneous experiments made by Junior Professor Marvin with a sling psychrometer and Regnault's hygrometer, from the latter part of March to the first part of August, 1885, in Colorado, at Colorado Springs, near the base of Pike's Peak; at the Trail House, on the trail up the mountain to the Peak, and on the Peak; and also from experiments made by Professors Marvin and Hazen in Washington, and by the latter in Massachusetts, the value of the constant A has been determined in the manner now to be described.

(7) In the first columns of the following table are given, in international measures, the temperatures  $\tau$  of the dry bulb and  $\tau_1$  of the wet bulb of the sling psychrometer, and the dew-point  $\delta$  observed with Regnault's hygrometer. Each of these temperatures is the average of ten readings of the thermometers taken alternately back and forth within a short time in such a manner as to make the averages equivalent to those of simultaneous readings. It is seen from the first column that a few of the experiments have been rejected. This, however, has not been done in any case where there was not some marginal note given by the experimenter to indicate that the experiment was not satisfactory

#### COLORADO SPRINGS-(FIRST SERIES.)

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## COLORADO SPRINGS-(FIRST SERIES)-Continued.

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## TRAIL HOUSE.

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216   9.77   4.08   -2.22   8.89   4.02   -13   286   16.86   6.87   -1.54   4.08   8.91   -1.77   1.17   7.28   2.16   -3.91   3.48   3.46   -0.08   287   15.82   7.00   -0.08   -0.21   4.57   4.52   +1.15   1.29   1.16   4.29   -1.26   4.17   4.18   -0.10   270   16.98   7.16   -1.21   4.18   8.94   +24   221   11.91   6.23   -1.25   4.17   4.20   -0.08   271   17.71   7.71   -2.29   8.86   8.90   -0.44   2.22   11.22   5.66   -0.71   4.34   4.39   -0.05   272   18.06   7.35   -2.29   8.86   8.90   -0.44   2.22   11.22   5.66   -0.71   4.34   4.39   -0.05   272   18.06   7.35   -2.29   8.86   8.72   -0.1   223   13.68   6.85   -0.68   -0.25   4.38   4.63   -1.5   274   18.35   7.76   -2.29   8.86   8.72   -0.1   223   13.66   6.43   -0.57   4.38   4.63   -1.5   274   18.35   7.76   -2.20   3.81   3.61   +2.0   225   13.66   6.43   -0.57   4.38   4.65   -2.7   275   11.85   7.76   2.76   5.66   5.62   -1.62   225   13.66   6.43   -0.57   4.38   4.55   -2.7   2.76   11.85   7.76   2.76   5.66   5.62   -1.62   225   13.66   6.43   -0.59   4.38   4.55   -2.7   2.76   11.85   7.76   2.76   5.66   5.62   -1.62   225   13.66   6.43   -0.59   4.38   4.55   -2.7   2.77   12.71   7.43   8.08   5.96   5.81   +1.72   227   8.19   6.44   -1.57   4.13   4.29   -1.16   2.79   16.51   6.46   -3.30   3.59   3.52   +1.72   228   13.66   6.47   -2.77   6.48   4.29   -1.16   2.79   16.51   6.46   -3.30   3.59   3.52   +1.72   220   13.49   6.40   -1.55   4.12   4.27   -1.15   280   16.05   6.47   -2.70   3.75   3.86   4.72   -1.55   4.10   4.24   4.35   -1.2   2.81   15.96   6.44   -2.52   3.80   3.68   +1.2   2.22   13.25   6.60   -0.81   4.31   4.38   -0.7   2.84   14.49   -0.51   -0.51   6.46   -3.30   3.59   3.52   +1.7   4.13   4.38   -0.99   -0.44   4.42   4.69   -2.7   2.86   14.59   -0.70   -11.29   1.94   2.81   1.15   2.22   11.20   6.60   -0.60   -0.60   4.73   -0.60   -0.60   -0.60   -0.60   -0.60   -0.60   -0.60   -0.60   -0.60   -0.60   -0.60   -0.60   -0.60   -0.60   -0.60   -0.60   -0.60   -0.60   -0.60   -0.60		Ι					I				
17						8.85 -0.04					4.16 1 0.06
218         7.79         2.56         -8.61         8.50         8.58         -08         288         16.85         7.56         0.31         4.67         4.62         +.15           219         9.83         3.91         -2.42         8.88         3.87         -04         289         17.02         7.89         -0.12         4.50         4.58         -0.8           220         11.46         4.94         -1.25         4.17         4.20         -0.03         271         17.71         7.71         7.41         -2.29         8.86         8.90         -0.04           222         11.26         6.25         -0.71         4.84         4.89         -0.5         272         18.06         7.35         -2.23         18.83         7.20         -1.01         2.20         18.83         7.37         -2.50         8.81         3.72         -0.01           225         11.266         6.43         -0.57         4.28         4.65         -2.7         276         11.25         7.73         -2.50         8.81         3.61         +.20           227         8.19         8.20         8.20         4.84         4.45         4.63         -1.7         12.73         8						4.0213					
229   1.64   4.94   -1.25   4.17   4.18   -0.1   270   17.02   7.89   -0.21   4.50   4.58   -0.68   -0.69   -0.21   4.50   4.58   -0.69   -0.21   4.50   4.50   -0.69   -0.21   4.50   4.50   -0.69   -0.21   4.50   4.50   -0.69   -0.21   4.50   4.50   -0.69   -0.21   4.50   4.50   -0.69   -0.21   4.50   4.50   -0.69   -0.21   4.50   4.50   -0.69   -0.21   4.50   4.50   -0.69   -0.21   4.50   4.50   -0.69   -0.21   4.50   4.50   -0.69   -0.21   4.50   4.50   -0.69   -0.21   4.50   4.50   -0.69   -0.21   4.50   4.50   -0.69   -0.21   4.50   -0.69   -0.21   4.50   -0.69   -0.21   4.50   -0.69   -0.21   4.50   -0.69   -0.21   4.50   -0.69   -0.21   4.50   -0.69   -0.21   4.50   -0.69   -0.21   4.50   -0.69   -0.21   4.50   -0.69   -0.21   4.50   -0.69   -0.21   4.50   -0.69   -0.21   -0.69   -0.21   -0.69   -0.21   -0.69   -0.21   -0.69   -0.21   -0.69   -0.21   -0.69   -0.21   -0.69   -0.21   -0.69   -0.21   -0.69   -0.21   -0.69   -0.21   -0.69   -0.21   -0.69   -0.21   -0.69   -0.21   -0.69   -0.21   -0.69   -0.21   -0.69   -0.21   -0.69   -0.21   -0.69   -0.21   -0.69   -0.21   -0.69   -0.21   -0.69   -0.21   -0.69   -0.21   -0.69   -0.21   -0.69   -0.21   -0.69   -0.21   -0.69   -0.21   -0.69   -0.21   -0.69   -0.21   -0.69   -0.21   -0.69   -0.21   -0.69   -0.21   -0.69   -0.21   -0.69   -0.21   -0.69   -0.21   -0.69   -0.21   -0.69   -0.21   -0.69   -0.21   -0.69   -0.21   -0.69   -0.21   -0.69   -0.21   -0.69   -0.21   -0.69   -0.21   -0.69   -0.21   -0.69   -0.21   -0.69   -0.21   -0.69   -0.21   -0.69   -0.21   -0.69   -0.21   -0.69   -0.21   -0.69   -0.21   -0.69   -0.21   -0.69   -0.21   -0.69   -0.21   -0.69   -0.21   -0.69   -0.21   -0.69   -0.21   -0.69   -0.21   -0.69   -0.21   -0.69   -0.21   -0.69   -0.21   -0.69   -0.21   -0.69   -0.21   -0.69   -0.21   -0.69   -0.21   -0.69   -0.21   -0.69   -0.21   -0.69   -0.21   -0.69   -0.21   -0.69   -0.21   -0.69   -0.21   -0.69   -0.21   -0.69   -0.21   -0.69   -0.21   -0.69   -0.21   -0.69   -0.21   -0.69   -0.21   -0.69   -0.21   -0.69   -0.21   -0.21   -				-8.91							
220   11.46   4.94   -1.25   4.17   4.20   -0.03   271   17.71   7.41   -2.20   8.86   8.90   -0.04   223   12.22   5.65   -0.71   4.84   4.89   -0.05   272   18.06   7.85   -2.83   8.71   8.72   -0.12   224   12.80   6.58   -0.28   4.48   4.63   -1.15   274   18.35   7.37   -2.50   2.81   8.61   -2.02   225   13.65   6.43   -0.97   4.83   4.44   -0.06   375   11.85   7.13   3.80   6.58   3.72   +1.14   227   218   3.86   6.43   -0.99   4.23   4.55   -2.72   276   11.85   7.13   3.80   6.56   6.63   -0.99   4.23   4.55   -2.72   276   11.85   7.13   3.80   6.59   6.81   +1.7   227   21.085   4.72   -1.83   4.00   4.14   -1.14   278   12.60   7.00   2.44   6.44   6.42   +0.02   227   229   12.08   6.57   6.75   -0.04   4.24   4.36   -1.12   281   13.25   6.64   -2.50   3.85   +0.7   229   12.08   6.04   -1.55   4.12   4.27   -1.15   280   16.05   6.47   -2.70   3.75   3.68   +0.7   221   12.08   6.01   -0.61   4.31   4.38   -0.7   284   15.44   6.05   -3.41   3.56   3.53   +0.3   223   14.38   6.89   -0.44   4.42   4.69   -2.77   286   15.96   6.44   -2.52   3.80   3.69   8.57   1.3   225   14.20   6.81   -0.08   4.72   4.66   -3.30   2.95   -0.50   -10.03   2.00   1.83   +1.3   223   14.39   6.67   6.75   6.64   6.51   -3.30   2.85   -0.50   -1.02   4.24   4.69   -2.77   286   15.96   6.44   -2.52   -1.25   -0.98   4.72   -1.65   -0.98   4.72   -1.65   -0.98   4.72   -1.65   -0.98   4.72   -1.65   -0.98   4.72   -1.65   -0.98   -0.75   -0.98   -0.75   -0.75   -0.75   -0.75   -0.75   -0.75   -0.98   -0.75   -0.98   -0.75   -0.98   -0.75   -0.98   -0.75   -0.98   -0.75   -0.98   -0.75   -0.98   -0.75   -0.75   -0.75   -0.75   -0.75   -0.75   -0.75   -0.75   -0.75   -0.75   -0.75   -0.75   -0.75   -0.75   -0.75   -0.75   -0.75   -0.75   -0.75   -0.75   -0.75   -0.75   -0.75   -0.75   -0.75   -0.75   -0.75   -0.75   -0.75   -0.75   -0.75   -0.75   -0.75   -0.75   -0.75   -0.75   -0.75   -0.75   -0.75   -0.75   -0.75   -0.75   -0.75   -0.75   -0.75   -0.75   -0.75   -0.75   -0.75   -0.75   -0.75   -0.75   -0.75   -0	210			-0.01							
221   11.91   6.28   -1.26   4.17   4.20   -0.08   271   17.71   7.41   -2.29   8.86   8.90   -0.04   223   12.80   6.22   -1.15   4.20   4.83   -1.18   273   18.64   7.67   -2.29   8.86   3.72   -1.14   224   12.80   6.43   -0.67   4.83   4.44   -0.06   275   12.20   7.06   2.76   5.56   5.64   -0.06   275   12.20   7.06   2.76   5.56   5.64   -0.06   275   12.20   7.06   2.76   5.56   5.64   -0.06   277   12.71   12.71   7.43   3.80   5.67   5.75   -0.07   228   10.85   4.72   -1.83   4.00   4.14   -1.14   278   12.62   7.00   2.44   5.44   5.44   -0.08   279   16.51   6.46   -3.30   3.59   3.52   +0.7   229   12.06   5.44   -1.37   4.13   4.29   -1.16   279   16.51   6.46   -3.30   3.59   3.52   +0.7   220   12.45   5.05   -1.02   4.24   4.35   -1.12   291   15.96   6.44   -2.52   8.80   8.68   +0.7   223   12.25   5.05   -1.02   4.24   4.35   -1.12   291   15.96   6.44   -2.52   8.80   8.68   +0.7   223   12.25   5.05   -1.02   4.24   4.35   -0.12   291   15.96   6.44   -2.52   8.80   8.68   +0.7   223   12.25   5.05   -0.08   4.27   4.66   -3.9   227   286   14.90   5.23   -5.11   3.13   3.20   -0.07   -0.81   4.31   4.38   -0.07   228   15.96   6.44   -2.52   8.80   8.68   +0.7   -0.83   4.84   -0.25   8.86   -0.25   8.86   8.90   -0.44   4.42   4.69   -0.27   286   15.44   6.05   -3.41   3.56   3.53   +0.33   -0.07   -0.83   4.27   4.66   -3.90   227   286   14.90   5.23   -5.11   291   1.94   2.81   +13   235   14.91   -7.49   -0.65   -0.65   -0.65   -0.65   -0.65   -0.65   -0.65   -0.65   -0.65   -0.65   -0.65   -0.65   -0.65   -0.65   -0.65   -0.65   -0.65   -0.65   -0.65   -0.65   -0.65   -0.65   -0.65   -0.65   -0.65   -0.65   -0.65   -0.65   -0.65   -0.65   -0.65   -0.65   -0.65   -0.65   -0.65   -0.65   -0.65   -0.65   -0.65   -0.65   -0.65   -0.65   -0.65   -0.65   -0.65   -0.65   -0.65   -0.65   -0.65   -0.65   -0.65   -0.65   -0.65   -0.65   -0.65   -0.65   -0.65   -0.65   -0.65   -0.65   -0.65   -0.65   -0.65   -0.65   -0.65   -0.65   -0.65   -0.65   -0.65   -0.65   -0.65   -0.65   -0.65   -0.	270		4 04	1 7 95	4 17				7 16 - 1 21		8 04 + 24
221 13.25 5.05 -1.02 4.24 4.3612 281 15.96 6.44 -2.52 8.80 8.68 +.12 (2.21 13.06 6.01 -0.81 4.31 4.3807 294 15.54 6.05 -3.41 3.56 8.53 +.06 323 14.33 6.89 -0.44 4.42 4.6927 286 14.90 5.23 -5.13 3.13 3.2007 294 14.30 6.81 -0.93 4.27 4.6639 297 6.19 -0.70 -11.29 1.94 2.81 +.13 25 14.99 7.46 0.47 4.73 5.0124 289 6.86 -0.25 -10.58 2.05 1.91 +.14 2.37 13.99 7.665 2.97 5.64 5.51 +.13 290 8.87 0.98 -9.58 2.22 2.01 +.21 288 14.17 8.35 3.46 5.84 6.0521 291 10.67 2.56 -7.83 2.55 2.51 +.16 290 14.96 6.77 0.30 4.67 4.78 -111 292 11.29 2.30 9 -7.41 2.63 2.45 +.18 211 15.14 7.08 -0.46 4.42 4.55 -1016 293 11.92 3.09 -7.41 2.63 2.45 +.18 211 15.14 7.08 -0.24 4.50 4.6414 295 13.83 4.22 -7.00 2.72 2.63 +.09 224 11.50 7.49 -0.15 4.56 4.7216 296 14.33 4.42 -6.73 2.76 2.61 +.15 244 15.00 7.40 -0.15 4.52 4.99 -3.37 297 14.79 4.76 6.45 2.83 2.71 +.12 255 16.44 8.00 0.39 4.70 4.8939 297 14.59 4.34 -7.12 2.69 2.54 +.15 2.55 16.44 8.00 0.39 4.70 4.8939 297 14.39 4.31 -7.12 2.69 2.54 +.15 2.55 16.44 8.00 0.39 4.70 4.8939 298 14.39 4.31 -7.12 2.69 2.54 +.15 2.55 16.44 8.00 0.39 4.70 4.8939 298 14.39 4.31 -7.12 2.69 2.54 +.15 2.55 16.44 8.00 0.39 4.70 4.8939 298 14.39 4.31 -7.12 2.69 2.54 +.15 2.55 16.44 8.00 0.39 4.70 4.8939 299 1.00 8.77 7.09 5.91 6.93 6.99 +.04 2.51 1.50 5.22 5.35 5.35 5.25 5.3500 302 11.00 7.73 5.80 6.88 6.9709 2.55 16.66 7.59 1.58 5.21 5.4120 302 11.00 7.73 5.80 6.88 6.9709 2.55 16.68 7.59 1.58 5.22 5.38 5.38 5.39 3.39 9.49 3.78 -2.26 3.89 3.79 3.89 -1.10 2.55 16.69 7.59 1.58 5.21 5.4100 302 11.00 7.98 5.54 6.75 6.8510 2.55 16.69 7.59 1.58 5.21 5.4100 302 11.00 7.79 7.79 5.80 6.88 6.9709 2.55 16.69 7.59 1.58 5.22 5.38 5.39 3.39 3.99 3.09 3.64 3.55 +.00 302 11.00 7.79 7.79 5.80 6.88 6.9709 2.55 1.83 5.21 5.4100 302 11.00 7.79 7.79 5.80 6.88 6.9709 2.55 1.58 5.22 5.38 5.39 3.39 3.99 3.99 3.64 3.89 3.7900 2.55 16.69 7.59 1.58 5.22 5.38 5.39 3.39 3.99 3.30 3.30 3.30 3.30 3.30 3	221			-1.26					7.41 - 2.20		8.9004
221 13.25 5.05 -1.02 4.24 4.3612 281 15.96 6.44 -2.52 8.80 8.68 +.12 (2.21 13.06 6.01 -0.81 4.31 4.3807 294 15.54 6.05 -3.41 3.56 8.53 +.06 323 14.33 6.89 -0.44 4.42 4.6927 286 14.90 5.23 -5.13 3.13 3.2007 294 14.30 6.81 -0.93 4.27 4.6639 297 6.19 -0.70 -11.29 1.94 2.81 +.13 25 14.99 7.46 0.47 4.73 5.0124 289 6.86 -0.25 -10.58 2.05 1.91 +.14 2.37 13.99 7.665 2.97 5.64 5.51 +.13 290 8.87 0.98 -9.58 2.22 2.01 +.21 288 14.17 8.35 3.46 5.84 6.0521 291 10.67 2.56 -7.83 2.55 2.51 +.16 290 14.96 6.77 0.30 4.67 4.78 -111 292 11.29 2.30 9 -7.41 2.63 2.45 +.18 211 15.14 7.08 -0.46 4.42 4.55 -1016 293 11.92 3.09 -7.41 2.63 2.45 +.18 211 15.14 7.08 -0.24 4.50 4.6414 295 13.83 4.22 -7.00 2.72 2.63 +.09 224 11.50 7.49 -0.15 4.56 4.7216 296 14.33 4.42 -6.73 2.76 2.61 +.15 244 15.00 7.40 -0.15 4.52 4.99 -3.37 297 14.79 4.76 6.45 2.83 2.71 +.12 255 16.44 8.00 0.39 4.70 4.8939 297 14.59 4.34 -7.12 2.69 2.54 +.15 2.55 16.44 8.00 0.39 4.70 4.8939 297 14.39 4.31 -7.12 2.69 2.54 +.15 2.55 16.44 8.00 0.39 4.70 4.8939 298 14.39 4.31 -7.12 2.69 2.54 +.15 2.55 16.44 8.00 0.39 4.70 4.8939 298 14.39 4.31 -7.12 2.69 2.54 +.15 2.55 16.44 8.00 0.39 4.70 4.8939 298 14.39 4.31 -7.12 2.69 2.54 +.15 2.55 16.44 8.00 0.39 4.70 4.8939 299 1.00 8.77 7.09 5.91 6.93 6.99 +.04 2.51 1.50 5.22 5.35 5.35 5.25 5.3500 302 11.00 7.73 5.80 6.88 6.9709 2.55 16.66 7.59 1.58 5.21 5.4120 302 11.00 7.73 5.80 6.88 6.9709 2.55 16.68 7.59 1.58 5.22 5.38 5.38 5.39 3.39 9.49 3.78 -2.26 3.89 3.79 3.89 -1.10 2.55 16.69 7.59 1.58 5.21 5.4100 302 11.00 7.98 5.54 6.75 6.8510 2.55 16.69 7.59 1.58 5.21 5.4100 302 11.00 7.79 7.79 5.80 6.88 6.9709 2.55 16.69 7.59 1.58 5.22 5.38 5.39 3.39 3.99 3.09 3.64 3.55 +.00 302 11.00 7.79 7.79 5.80 6.88 6.9709 2.55 1.83 5.21 5.4100 302 11.00 7.79 7.79 5.80 6.88 6.9709 2.55 1.58 5.22 5.38 5.39 3.39 3.99 3.99 3.64 3.89 3.7900 2.55 16.69 7.59 1.58 5.22 5.38 5.39 3.39 3.99 3.30 3.30 3.30 3.30 3.30 3	223		5 65	-0.71	4.84	4.8905				8.71	8.7201
221 13.25 5.05 -1.02 4.24 4.3612 281 15.96 6.44 -2.52 8.80 8.68 +.12 (2.21 13.06 6.01 -0.81 4.31 4.3807 294 15.54 6.05 -3.41 3.56 8.53 +.06 323 14.33 6.89 -0.44 4.42 4.6927 286 14.90 5.23 -5.13 3.13 3.2007 294 14.30 6.81 -0.93 4.27 4.6639 297 6.19 -0.70 -11.29 1.94 2.81 +.13 25 14.99 7.46 0.47 4.73 5.0124 289 6.86 -0.25 -10.58 2.05 1.91 +.14 2.37 13.99 7.665 2.97 5.64 5.51 +.13 290 8.87 0.98 -9.58 2.22 2.01 +.21 288 14.17 8.35 3.46 5.84 6.0521 291 10.67 2.56 -7.83 2.55 2.51 +.16 290 14.96 6.77 0.30 4.67 4.78 -111 292 11.29 2.30 9 -7.41 2.63 2.45 +.18 211 15.14 7.08 -0.46 4.42 4.55 -1016 293 11.92 3.09 -7.41 2.63 2.45 +.18 211 15.14 7.08 -0.24 4.50 4.6414 295 13.83 4.22 -7.00 2.72 2.63 +.09 224 11.50 7.49 -0.15 4.56 4.7216 296 14.33 4.42 -6.73 2.76 2.61 +.15 244 15.00 7.40 -0.15 4.52 4.99 -3.37 297 14.79 4.76 6.45 2.83 2.71 +.12 255 16.44 8.00 0.39 4.70 4.8939 297 14.59 4.34 -7.12 2.69 2.54 +.15 2.55 16.44 8.00 0.39 4.70 4.8939 297 14.39 4.31 -7.12 2.69 2.54 +.15 2.55 16.44 8.00 0.39 4.70 4.8939 298 14.39 4.31 -7.12 2.69 2.54 +.15 2.55 16.44 8.00 0.39 4.70 4.8939 298 14.39 4.31 -7.12 2.69 2.54 +.15 2.55 16.44 8.00 0.39 4.70 4.8939 298 14.39 4.31 -7.12 2.69 2.54 +.15 2.55 16.44 8.00 0.39 4.70 4.8939 299 1.00 8.77 7.09 5.91 6.93 6.99 +.04 2.51 1.50 5.22 5.35 5.35 5.25 5.3500 302 11.00 7.73 5.80 6.88 6.9709 2.55 16.66 7.59 1.58 5.21 5.4120 302 11.00 7.73 5.80 6.88 6.9709 2.55 16.68 7.59 1.58 5.22 5.38 5.38 5.39 3.39 9.49 3.78 -2.26 3.89 3.79 3.89 -1.10 2.55 16.69 7.59 1.58 5.21 5.4100 302 11.00 7.98 5.54 6.75 6.8510 2.55 16.69 7.59 1.58 5.21 5.4100 302 11.00 7.79 7.79 5.80 6.88 6.9709 2.55 16.69 7.59 1.58 5.22 5.38 5.39 3.39 3.99 3.09 3.64 3.55 +.00 302 11.00 7.79 7.79 5.80 6.88 6.9709 2.55 1.83 5.21 5.4100 302 11.00 7.79 7.79 5.80 6.88 6.9709 2.55 1.58 5.22 5.38 5.39 3.39 3.99 3.99 3.64 3.89 3.7900 2.55 16.69 7.59 1.58 5.22 5.38 5.39 3.39 3.99 3.30 3.30 3.30 3.30 3.30 3	223	12.63		-1.15		4.8818			7.61 - 2.29	8.86	8.72 + .14
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221 13.25 5.05 -1.02 4.24 4.3612 281 15.96 6.44 -2.52 8.80 8.68 +.12 (2.21 13.06 6.01 -0.81 4.31 4.3807 294 15.54 6.05 -3.41 3.56 8.53 +.06 323 14.33 6.89 -0.44 4.42 4.6927 286 14.90 5.23 -5.13 3.13 3.2007 294 14.30 6.81 -0.93 4.27 4.6639 297 6.19 -0.70 -11.29 1.94 2.81 +.13 25 14.99 7.46 0.47 4.73 5.0124 289 6.86 -0.25 -10.58 2.05 1.91 +.14 2.37 13.99 7.665 2.97 5.64 5.51 +.13 290 8.87 0.98 -9.58 2.22 2.01 +.21 288 14.17 8.35 3.46 5.84 6.0521 291 10.67 2.56 -7.83 2.55 2.51 +.16 290 14.96 6.77 0.30 4.67 4.78 -111 292 11.29 2.30 9 -7.41 2.63 2.45 +.18 211 15.14 7.08 -0.46 4.42 4.55 -1016 293 11.92 3.09 -7.41 2.63 2.45 +.18 211 15.14 7.08 -0.24 4.50 4.6414 295 13.83 4.22 -7.00 2.72 2.63 +.09 224 11.50 7.49 -0.15 4.56 4.7216 296 14.33 4.42 -6.73 2.76 2.61 +.15 244 15.00 7.40 -0.15 4.52 4.99 -3.37 297 14.79 4.76 6.45 2.83 2.71 +.12 255 16.44 8.00 0.39 4.70 4.8939 297 14.59 4.34 -7.12 2.69 2.54 +.15 2.55 16.44 8.00 0.39 4.70 4.8939 297 14.39 4.31 -7.12 2.69 2.54 +.15 2.55 16.44 8.00 0.39 4.70 4.8939 298 14.39 4.31 -7.12 2.69 2.54 +.15 2.55 16.44 8.00 0.39 4.70 4.8939 298 14.39 4.31 -7.12 2.69 2.54 +.15 2.55 16.44 8.00 0.39 4.70 4.8939 298 14.39 4.31 -7.12 2.69 2.54 +.15 2.55 16.44 8.00 0.39 4.70 4.8939 299 1.00 8.77 7.09 5.91 6.93 6.99 +.04 2.51 1.50 5.22 5.35 5.35 5.25 5.3500 302 11.00 7.73 5.80 6.88 6.9709 2.55 16.66 7.59 1.58 5.21 5.4120 302 11.00 7.73 5.80 6.88 6.9709 2.55 16.68 7.59 1.58 5.22 5.38 5.38 5.39 3.39 9.49 3.78 -2.26 3.89 3.79 3.89 -1.10 2.55 16.69 7.59 1.58 5.21 5.4100 302 11.00 7.98 5.54 6.75 6.8510 2.55 16.69 7.59 1.58 5.21 5.4100 302 11.00 7.79 7.79 5.80 6.88 6.9709 2.55 16.69 7.59 1.58 5.22 5.38 5.39 3.39 3.99 3.09 3.64 3.55 +.00 302 11.00 7.79 7.79 5.80 6.88 6.9709 2.55 1.83 5.21 5.4100 302 11.00 7.79 7.79 5.80 6.88 6.9709 2.55 1.58 5.22 5.38 5.39 3.39 3.99 3.99 3.64 3.89 3.7900 2.55 16.69 7.59 1.58 5.22 5.38 5.39 3.39 3.99 3.30 3.30 3.30 3.30 3.30 3	<b>Z26</b>	13,65	6.43		4.28			11.85		5.98	5.81  + .17
221 13.25 5.06 -1.02 4.24 4.3612 281 15.96 6.44 -2.52 3.80 8.68 + .12 23 13.80 6.01 -0.81 4.31 4.3807 284 115.96 6.05 - 3.41 3.56 3.53 + .03 233 14.33 6.89 -0.44 4.42 4.6927 286 14.90 5.23 - 5.13 3.13 3.2007 234 14.20 6.81 -0.93 4.27 4.6639 287 6.19 -0.70 -11.29 1.94 2.81 + .18 235 14.99 7.49 0.47 4.73 5.0123 288 6.85 -0.50 -10.93 2.00 1.83 + .18 237 13.89 7.65 2.97 5.64 5.51 + .13 290 8.87 -0.26 -10.58 2.06 1.91 + .14 237 13.89 7.65 2.97 5.64 5.51 + .13 290 8.87 -0.26 -7.83 2.55 2.51 + .04 2.91 14.90 6.97 -0.93 4.67 4.78 -11 292 11.20 2.63 -7.83 2.55 2.51 + .04 2.91 14.95 7.61 1.10 4.94 5.1016 293 11.92 3.09 -7.41 2.63 2.45 + .18 241 15.14 7.08 -0.46 4.42 4.5513 294 12.14 3.15 -7.44 2.63 2.45 + .18 241 15.14 7.08 -0.46 4.42 4.5513 294 12.14 3.15 -7.44 2.63 2.45 + .18 241 15.00 7.13 -0.07 4.56 4.7216 296 14.33 4.42 -6.73 2.76 2.61 + .15 244 15.00 7.40 -0.15 4.52 4.8937 297 14.79 4.74 -6.45 2.83 2.71 + .12 244 15.00 7.40 -0.15 4.52 4.8937 297 14.79 4.74 -6.45 2.83 2.71 + .15 245 16.44 8.00 0.89 4.70 4.8919 298 14.39 6.87 7.09 5.91 6.98 6.98 6.9900 224 14.80 7.13 -0.07 4.56 4.7216 296 14.33 4.42 -6.73 2.76 2.61 + .15 245 16.44 8.00 0.89 4.70 4.8919 298 14.39 6.37 7.09 5.91 6.98 6.9900 2.72 2.63 + .09 249 16.55 8.52 1.83 5.21 5.4120 302 11.00 7.79 5.91 6.88 6.9709 229 16.56 8.52 1.83 5.21 5.4120 302 11.00 7.79 5.51 6.88 6.9709 5.20 16.47 8.75 9.15 8.52 1.53 5.2407 304 11.07 7.98 5.54 6.75 6.8510 250 16.47 8.75 9.15 8.52 5.53 5.34 5.00 305 11.50 7.99 5.54 6.8510 250 16.47 8.75 9.15 8.52 6.58 5.5830 303 10.11 7.74 5.83 8.90 8.77 1.70 8.86 1.99 8.54 6.65 6.7711 312 18.19 6.60 4.25 3.89 3.70 3.70 3.70 3.7202 15.05 8.65 8.52 1.83 5.21 5.4107 306 11.50 7.99 5.54 6.8510 307 11.00 7.99 5.54 6.85 7.1000 307 11.00 7.99 5.54 6.85 7.1000 307 11.00 7.99 5.54 6.85 7.1000 307 11.00 7.99 5.54 6.85 7.1000 307 11.00 7.99 5.54 6.85 7.1000 307 11.00 7.99 5.54 6.85 7.1000 307 11.00 7.99 5.54 6.85	227		8.72	_1.92		8.95 + .02					
221 13.25 5.06 -1.02 4.24 4.3612 281 15.96 6.44 -2.52 3.80 8.68 + .12 23 13.80 6.01 -0.81 4.31 4.3807 284 115.96 6.05 - 3.41 3.56 3.53 + .03 233 14.33 6.89 -0.44 4.42 4.6927 286 14.90 5.23 - 5.13 3.13 3.2007 234 14.20 6.81 -0.93 4.27 4.6639 287 6.19 -0.70 -11.29 1.94 2.81 + .18 235 14.99 7.49 0.47 4.73 5.0123 288 6.85 -0.50 -10.93 2.00 1.83 + .18 237 13.89 7.65 2.97 5.64 5.51 + .13 290 8.87 -0.26 -10.58 2.06 1.91 + .14 237 13.89 7.65 2.97 5.64 5.51 + .13 290 8.87 -0.26 -7.83 2.55 2.51 + .04 2.91 14.90 6.97 -0.93 4.67 4.78 -11 292 11.20 2.63 -7.83 2.55 2.51 + .04 2.91 14.95 7.61 1.10 4.94 5.1016 293 11.92 3.09 -7.41 2.63 2.45 + .18 241 15.14 7.08 -0.46 4.42 4.5513 294 12.14 3.15 -7.44 2.63 2.45 + .18 241 15.14 7.08 -0.46 4.42 4.5513 294 12.14 3.15 -7.44 2.63 2.45 + .18 241 15.00 7.13 -0.07 4.56 4.7216 296 14.33 4.42 -6.73 2.76 2.61 + .15 244 15.00 7.40 -0.15 4.52 4.8937 297 14.79 4.74 -6.45 2.83 2.71 + .12 244 15.00 7.40 -0.15 4.52 4.8937 297 14.79 4.74 -6.45 2.83 2.71 + .15 245 16.44 8.00 0.89 4.70 4.8919 298 14.39 6.87 7.09 5.91 6.98 6.98 6.9900 224 14.80 7.13 -0.07 4.56 4.7216 296 14.33 4.42 -6.73 2.76 2.61 + .15 245 16.44 8.00 0.89 4.70 4.8919 298 14.39 6.37 7.09 5.91 6.98 6.9900 2.72 2.63 + .09 249 16.55 8.52 1.83 5.21 5.4120 302 11.00 7.79 5.91 6.88 6.9709 229 16.56 8.52 1.83 5.21 5.4120 302 11.00 7.79 5.51 6.88 6.9709 5.20 16.47 8.75 9.15 8.52 1.53 5.2407 304 11.07 7.98 5.54 6.75 6.8510 250 16.47 8.75 9.15 8.52 5.53 5.34 5.00 305 11.50 7.99 5.54 6.8510 250 16.47 8.75 9.15 8.52 6.58 5.5830 303 10.11 7.74 5.83 8.90 8.77 1.70 8.86 1.99 8.54 6.65 6.7711 312 18.19 6.60 4.25 3.89 3.70 3.70 3.70 3.7202 15.05 8.65 8.52 1.83 5.21 5.4107 306 11.50 7.99 5.54 6.8510 307 11.00 7.99 5.54 6.85 7.1000 307 11.00 7.99 5.54 6.85 7.1000 307 11.00 7.99 5.54 6.85 7.1000 307 11.00 7.99 5.54 6.85 7.1000 307 11.00 7.99 5.54 6.85 7.1000 307 11.00 7.99 5.54 6.85 7.1000 307 11.00 7.99 5.54 6.85	225			-1.83		4.14  14	278				5.42   + .02
221 13.25 5.06 -1.02 4.24 4.3612 281 15.96 6.44 -2.52 3.80 8.68 + .12 23 13.80 6.01 -0.81 4.31 4.3807 284 115.96 6.05 - 3.41 3.56 3.53 + .03 233 14.33 6.89 -0.44 4.42 4.6927 286 14.90 5.23 - 5.13 3.13 3.2007 234 14.20 6.81 -0.93 4.27 4.6639 287 6.19 -0.70 -11.29 1.94 2.81 + .18 235 14.99 7.49 0.47 4.73 5.0123 288 6.85 -0.50 -10.93 2.00 1.83 + .18 237 13.89 7.65 2.97 5.64 5.51 + .13 290 8.87 -0.26 -10.58 2.06 1.91 + .14 237 13.89 7.65 2.97 5.64 5.51 + .13 290 8.87 -0.26 -7.83 2.55 2.51 + .04 2.91 14.90 6.97 -0.93 4.67 4.78 -11 292 11.20 2.63 -7.83 2.55 2.51 + .04 2.91 14.95 7.61 1.10 4.94 5.1016 293 11.92 3.09 -7.41 2.63 2.45 + .18 241 15.14 7.08 -0.46 4.42 4.5513 294 12.14 3.15 -7.44 2.63 2.45 + .18 241 15.14 7.08 -0.46 4.42 4.5513 294 12.14 3.15 -7.44 2.63 2.45 + .18 241 15.00 7.13 -0.07 4.56 4.7216 296 14.33 4.42 -6.73 2.76 2.61 + .15 244 15.00 7.40 -0.15 4.52 4.8937 297 14.79 4.74 -6.45 2.83 2.71 + .12 244 15.00 7.40 -0.15 4.52 4.8937 297 14.79 4.74 -6.45 2.83 2.71 + .15 245 16.44 8.00 0.89 4.70 4.8919 298 14.39 6.87 7.09 5.91 6.98 6.98 6.9900 224 14.80 7.13 -0.07 4.56 4.7216 296 14.33 4.42 -6.73 2.76 2.61 + .15 245 16.44 8.00 0.89 4.70 4.8919 298 14.39 6.37 7.09 5.91 6.98 6.9900 2.72 2.63 + .09 249 16.55 8.52 1.83 5.21 5.4120 302 11.00 7.79 5.91 6.88 6.9709 229 16.56 8.52 1.83 5.21 5.4120 302 11.00 7.79 5.51 6.88 6.9709 5.20 16.47 8.75 9.15 8.52 1.53 5.2407 304 11.07 7.98 5.54 6.75 6.8510 250 16.47 8.75 9.15 8.52 5.53 5.34 5.00 305 11.50 7.99 5.54 6.8510 250 16.47 8.75 9.15 8.52 6.58 5.5830 303 10.11 7.74 5.83 8.90 8.77 1.70 8.86 1.99 8.54 6.65 6.7711 312 18.19 6.60 4.25 3.89 3.70 3.70 3.70 3.7202 15.05 8.65 8.52 1.83 5.21 5.4107 306 11.50 7.99 5.54 6.8510 307 11.00 7.99 5.54 6.85 7.1000 307 11.00 7.99 5.54 6.85 7.1000 307 11.00 7.99 5.54 6.85 7.1000 307 11.00 7.99 5.54 6.85 7.1000 307 11.00 7.99 5.54 6.85 7.1000 307 11.00 7.99 5.54 6.85 7.1000 307 11.00 7.99 5.54 6.85	229			-1.87		4.2916			6.46 - 3.30		3.52 + .07
233       14.33       6.89       — 0.44       4.42       4.69       — .77       286       14.90       5.81       3.13       8.20       — .77         234       14.20       6.81       — 0.98       4.27       4.66       — 39       287       6.19       — 0.70       — 11.29       1.94       2.81       + 1.8         235       14.90       7.17       0.03       4.58       4.84       — .93       288       6.58       — 0.50       — 10.93       2.00       1.82       + 1.8         237       18.89       7.65       2.97       5.64       5.51       + 1.3       290       8.87       — 0.26       — 10.58       2.22       2.01       + 21         239       14.29       6.97       0.30       4.67       4.78       — 11       291       11.20       2.68       — 7.70       2.57       2.51       + 16         240       14.95       7.61       1.10       4.94       5.10       — .16       293       11.29       2.63       — 7.70       2.57       2.51       + 16         241       15.16       7.06       — 0.74       4.55       — 13       294       14.79       4.74       2.62       2.41	230			-1.85		4.27  15					8.68   + .07
233       14.33       6.89       — 0.44       4.42       4.69       — .77       286       14.90       5.81       3.13       8.20       — .77         234       14.20       6.81       — 0.98       4.27       4.66       — 39       287       6.19       — 0.70       — 11.29       1.94       2.81       + 1.8         235       14.90       7.17       0.03       4.58       4.84       — .93       288       6.58       — 0.50       — 10.93       2.00       1.82       + 1.8         237       18.89       7.65       2.97       5.64       5.51       + 1.3       290       8.87       — 0.26       — 10.58       2.22       2.01       + 21         239       14.29       6.97       0.30       4.67       4.78       — 11       291       11.20       2.68       — 7.70       2.57       2.51       + 16         240       14.95       7.61       1.10       4.94       5.10       — .16       293       11.29       2.63       — 7.70       2.57       2.51       + 16         241       15.16       7.06       — 0.74       4.55       — 13       294       14.79       4.74       2.62       2.41	291			-1.02		4.3012					8.08 7 .12
289 14.79	232					4.3807			5.00 T 5.41		
289 14.79	234				4 97	1.68 - 30					2 81 + 19
289 14.79	235		7 17		4.58	184 - 23					1 89 + 18
289 14.79	226					5.0124					
289 14.79	237					5.51 + .13					
241       15.14       7.08       -0.46       4.42       4.55      13       294       12.14       8.15       -7.44       2.62       2.41       +.20         242       14.80       7.13       -0.07       4.56       4.72      16       296       14.33       4.42       -6.73       2.76       2.61       +.15         244       15.00       7.40       -0.15       4.52       4.89      19       297       14.79       4.74       -6.45       2.83       2.71       +.12         245       16.44       8.00       0.89       4.70       4.89      19       298       14.33       4.22       -6.73       2.56       2.54       +.15         246       16.43       8.17       0.69       4.80       5.05      21       299       7.75       6.90       6.03       6.98       7.11      13         247       17.06       8.61       0.80       4.84       5.22      38       (9)       7.75       6.90       6.93       6.89       7.11      13         248       16.67       8.60       1.24       4.99       5.36      37       301       10.11       7.73       5.80	238	14.17				6.0521			2.56 - 7.83		2.51 + .04
241       15.14       7.08       -0.46       4.42       4.55      13       294       12.14       8.15       -7.44       2.62       2.41       +.20         242       14.80       7.13       -0.07       4.56       4.72      16       296       14.33       4.42       -6.73       2.76       2.61       +.15         244       15.00       7.40       -0.15       4.52       4.89      19       297       14.79       4.74       -6.45       2.83       2.71       +.12         245       16.44       8.00       0.89       4.70       4.89      19       298       14.33       4.22       -6.73       2.56       2.54       +.15         246       16.43       8.17       0.69       4.80       5.05      21       299       7.75       6.90       6.03       6.98       7.11      13         247       17.06       8.61       0.80       4.84       5.22      38       (9)       7.75       6.90       6.93       6.89       7.11      13         248       16.67       8.60       1.24       4.99       5.36      37       301       10.11       7.73       5.80	239	14.20		0.30	4.67					2.57	2.51 + .16
242 14.67 6.97 -0.22 4.50 4.6414 295 13.83 4.22 -7.00 2.72 2.63 + .09 242 14.89 7.13 -0.07 4.56 4.7216 296 14.33 4.22 -6.73 2.76 2.61 + .15 244 15.00 7.40 -0.15 4.52 4.8937 297 14.79 4.74 -6.45 2.83 2.71 + .12 2.55 16.44 8.00 0.39 4.70 4.8919 298 14.39 4.31 - 7.12 2.69 2.54 + .15 246 16.43 8.17 0.69 4.80 5.0521 299 7.75 6.90 6.03 6.98 7.1113 247 17.06 8.61 0.80 4.84 5.2233 (00) 8.77 7.09 5.91 6.03 6.98 7.1113 247 17.06 8.61 0.80 4.84 5.2233 (00) 8.77 7.09 5.91 6.03 6.89 6.89 6.9709 249 16.35 8.52 1.83 5.21 5.4120 302 11.00 7.98 5.54 6.75 6.8510 250 16.47 8.75 2.05 5.28 5.5839 303 9.49 3.78 - 2.56 3.79 8.9010 251 14.66 7.59 1.58 5.12 5.1809 304 10.17 7.93 5.80 6.88 6.9709 252 15.05 8.05 2.28 5.88 5.4603 305 11.50 4.50 - 2.87 3.70 3.7202 253 16.10 8.24 2.11 5.31 5.24 + .07 306 12.36 4.89 - 2.20 3.89 3.73 + .16 254 16.94 8.26 2.13 5.31 5.3201 307 13.14 5.33 - 3.09 3.64 3.8016 254 15.98 8.19 2.11 5.31 5.24 + .07 306 12.36 4.89 - 2.20 3.89 3.73 + .16 255 15.98 8.19 2.11 5.31 5.3201 307 13.14 5.33 - 3.09 3.64 3.8016 256 16.31 8.50 2.39 5.42 5.42 70 309 16.53 6.75 - 2.04 3.94 3.74 + .20 27 17.11 8.59 2.17 5.33 5.21 + .13 310 17.94 7.2330 3.48 3.37 + .11 259 18.09 9.86 5.34 6.66 6.7711 312 18.19 6.60 4.25 3.34 2.99 + .33 250 18.09 9.55 4.58 6.52 6.60 6.52 + .03 314 16.89 9.59 4.58 6.32 6.6705 314 16.89 9.59 4.58 6.32 6.6705 314 16.89 9.59 4.58 6.32 6.6705 314 16.89 9.59 4.58 6.32 6.6705 314 16.89 9.59 4.58 6.32 6.60 6.5711 312 18.19 6.60 4.25 3.34 2.99 9.49 3.14 .09 9.59 4.58 6.32 6.3705 314 16.89 9.59 7.75 7.75 2.20 2.20 2.20 2.20 2.20 2.20 2.20 2.2	240								3.09 - 7.41		2.45 + .18
244   15,00   7,40   -0.16   4.52   4.89  17   296   14.79   4.74   -6.43   2.83   2.71   +.12   245   16.44   8.00   0.89   4.70   4.89  17   296   14.39   4.31   -7.12   2.69   2.54   +.15   246   16.43   8.17   0.69   4.84   5.22  38   3.00   8.77   7.09   5.91   6.93   6.98   7.11  13   7.71   7.73   5.80   6.83   6.89   7.11  13   7.72   7.73   7.74   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75	241					4.5513			8.15 - 7.44	2.62	2.41  + .21
244   15,00   7,40   -0.16   4.52   4.89  17   296   14.79   4.74   -6.43   2.83   2.71   +.12   245   16.44   8.00   0.89   4.70   4.89  17   296   14.39   4.31   -7.12   2.69   2.54   +.15   246   16.43   8.17   0.69   4.84   5.22  38   3.00   8.77   7.09   5.91   6.93   6.98   7.11  13   7.71   7.73   5.80   6.83   6.89   7.11  13   7.72   7.73   7.74   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75   7.75						4.6414			4.22 - 7.00		2.63 + .09
246 16.43 8.77 0.69 4.80 5.05 -23 299 7.75 6.90 6.03 6.98 7.11 -15 17.06 8.61 0.80 4.84 5.22 -38 20 18.77 7.09 5.91 6.03 6.89 7.11 -15 17.06 8.61 0.80 4.84 5.22 -38 20 10.11 7.73 5.80 6.88 6.97 -09 10.11 7.73 5.80 6.88 6.97 -09 10.11 7.73 5.80 6.88 6.97 -09 10.11 7.73 5.80 6.88 6.97 -09 10.11 14.66 7.59 1.58 5.12 5.18 -09 304 10.17 3.67 -3.09 3.64 3.55 +09 10.11 14.66 7.59 1.58 5.12 5.18 -09 304 10.17 3.67 -3.09 3.64 3.55 +09 10.11 15.06 8.06 8.24 2.11 5.31 5.24 +07 306 12.36 4.89 -2.20 8.89 3.73 +16 234 15.98 8.19 2.11 5.31 5.24 +07 306 12.36 4.89 -2.20 8.89 3.73 +16 236 15.98 8.19 2.11 5.31 5.24 +07 306 14.25 5.33 -3.02 3.62 8.53 +07 256 16.31 8.50 2.89 5.42 5.42 0.00 309 16.53 6.75 -2.04 8.94 8.26 2.13 5.31 5.24 +07 306 14.25 5.33 -3.02 3.62 8.53 +07 256 16.31 8.50 2.89 5.42 5.42 0.00 309 16.53 6.75 -2.04 8.94 8.74 +2.20 2.17 11.8 5.99 1.4 8.75 6.45 6.59 -14 311 18.17 7.02 -3.70 3.48 3.70 -07 256 16.79 9.96 5.34 6.66 6.77 -11 312 18.19 6.60 4.25 3.34 2.99 +33 200 16.09 9.61 5.22 6.60 6.52 +08 313 15.59 5.64 -5.41 3.06 3.14 -08 201 16.09 9.50 4.58 6.32 6.37 -05 314 16.89 5.70 -7.55 2.00 2.71 1.01 4.23 17.00 9.02 3.16 5.72 5.58 1.13 316 17.50 6.99 5.77 -7.55 2.20 2.90 2.90 +.09 256 10.41 4.42 4.50 9.02 2.90 4.23 3.04 3.14 -08 201 16.09 9.02 3.14 4.83 13.15 17.50 6.99 5.70 -7.55 2.20 2.90 2.90 +.09 256 10.41 4.42 4.50 4.23 4.10 +13 316 18.10 6.99 5.70 -7.55 2.20 2.90 2.90 +.09 256 10.41 4.42 4.10 4.23 4.10 +13 316 18.10 6.99 5.70 -7.55 2.20 2.90 2.90 +.09 256 10.41 4.42 4.10 4.23 4.10 +13 316 18.10 6.99 5.70 -7.55 2.20 2.90 2.90 +.09 256 10.41 4.42 4.10 4.23 4.10 +13 316 18.10 6.99 5.70 -7.55 2.20 3.08 3.23 -20 256 10.41 4.42 4.10 4.23 4.10 4.23 4.10 4.23 4.10 4.23 4.10 4.23 4.10 4.23 4.10 4.23 4.10 4.23 4.10 4.23 4.10 4.23 4.10 4.23 4.10 4.23 4.10 4.23 4.10 4.23 4.10 4.23 4.10 4.23 4.10 4.23 4.10 4.23 4.10 4.23 4.10 4.23 4.10 4.23 4.10 4.23 4.10 4.23 4.10 4.23 4.10 4.23 4.10 4.23 4.10 4.23 4.10 4.23 4.10 4.23 4.10 4.23 4.10 4.23 4.10 4.23 4.10 4.23 4.10 4.23 4.10 4.23 4.10 4.23 4.10 4.23 4.10 4.23 4.10 4.23 4.	243		7.13			4.7216				2.76	2.61 + .15
246       16.43       8.17       0.69       4.80       5.05       — .23       (29)       7.75       6.90       6.03       6.98       7.11       — .13         247       17.06       8.61       0.80       4.84       5.22       — .38       (20)       7.70       5.90       6.93       6.98       7.11       — .13         248       16.67       8.60       1.24       4.99       5.36       — .37       301       10.11       7.73       5.80       6.88       6.97       — .09         249       16.35       8.52       1.83       5.21       5.41       — .20       302       11.00       7.98       5.54       6.75       6.85       — .09         250       16.47       8.75       2.05       5.28       5.88      01       302       11.00       7.98       5.54       6.75       6.85       — 10         251       16.46       7.59       1.58       5.12       5.18       — .09       304       10.17       3.67       — 3.09       3.64       3.55       + .09         252       15.05       8.05       2.28       5.38       5.46       — .08       304       10.17       3.67       — 3.09<	244							14.79	4.21 - 7.12		
247         17.06         8.61         0.80         4.84         5.22         — 38         100         8.77         7.09         5.91         6.93         6.89         + .04           248         16.67         8.60         1.24         4.99         5.36         — 37         301         10.11         7.73         5.90         6.88         6.89         + .04           249         16.35         8.52         1.83         5.21         5.41        20         302         11.01         7.73         5.80         6.88         6.89        09           250         16.47         8.75         2.05         5.28         5.58        91         394         3.73         - 2.58         3.79         3.89        10           251         14.66         7.59         1.58         5.12         5.18        09         304         10.17         3.67         - 3.09         3.64         3.55        09           252         15.05         8.05         2.28         5.38         5.46        03         305         11.50         4.50         - 2.87         3.70         3.72        02           252         15.40         8.22         2.1									6 00 6 03		
249         16.67         8.60         1.24         4.99         5.36									7.09 5.91		6.80 + 04
249         16.35         8, 52         1, 83         5, 21         5, 41         -         20         302         11, 09         7, 99         5, 54         6, 75         6, 85         -         10           250         16, 47         8, 75         2, 05         5, 28         5, 58         -         303         10, 17         3, 67         -         3, 09         3, 64         3, 55         -         10           252         15, 08         7, 59         1, 58         5, 12         5, 18         -         90         304         10, 17         3, 67         -         3, 09         3, 64         3, 55         +         .         9         22         15, 08         8, 05         2, 28         5, 88         5, 46         -         03         305         11, 50         4, 50         -         2, 87         3, 72         2, 72         -         02         2, 20         3, 89         -         16         30         11, 50         4, 50         -         2, 87         3, 72         3, 72         2, 72         -         02         2, 20         3, 89         -         10         305         11, 50         4, 50         2, 20         2, 87         3, 70						5 36 - 37					
250   16.47   8.75   2.06   5.28   5.58  30   9.33   9.49   3.78   -2.56   3.79   8.89  10   251   14.66   7.59   1.58   5.12   5.18  09   304   10.17   3.67   -3.00   3.64   3.55   +.09   252   15.05   8.05   2.28   5.88   5.46  08   305   11.50   4.50   -2.57   3.70   3.72  02   253   16.10   8.24   2.11   5.31   5.24   +.07   306   12.36   4.89   -2.20   3.89   3.73   +.16   254   15.98   8.19   2.11   5.31   5.24   +.07   306   14.25   5.53   -3.29   3.64   3.80  16   256   16.51   8.50   2.39   5.42   5.42  00   309   16.53   6.75   -2.04   3.94   3.74   +.20   257   17.11   8.59   2.17   5.33   5.29   +.13   310   17.94   7.22   -3.14   3.63   3.70  20   258   16.72   9.91   4.87   6.45   6.59  14   311   18.17   7.02   -3.70   3.48   3.37   +.11   259   16.09   9.61   5.22   6.60   6.72  11   312   18.19   6.60   -4.25   3.44   3.05   3.14  08   250   16.09   9.50   4.58   6.32   6.37  05   314   16.89   5.70   -7.55   2.20   2.71  11   250   16.41   4.48   9.90   9.02   3.16   5.72   5.58   4.10   +.13   316   17.50   6.87   -5.22   3.08   3.23   -20	240			1.83		5.4120			7.98 5.54		6.8510
522         15.05         8.05         2.28         5.38         5.46         —.03         305         11.50         4.50         —.2.87         3.70         3.72         —.02           233         16.10         8.24         2.11         5.31         5.24         +.07         306         12.36         4.89         —.2.20         3.89         3.73         +.16           245         15.98         8.19         2.11         5.31         5.24         +.07         306         14.25         5.33         —3.09         3.64         3.80         —.16           256         18.31         8.50         2.39         5.42         5.42         5.00         309         16.53         6.73         —2.04         3.94         3.74         +.20           277         17.11         8.59         2.17         5.33         5.29        14         311         18.17         7.02        3.70         3.48         3.74         +.20           281         18.09         9.91         4.87         6.45         6.59        14         311         18.17         7.02        3.70         3.48         3.37         +.11           380         18.09         9.86 <th>250</th> <th></th> <th>8,75</th> <th></th> <th>5.28</th> <th>5.5830</th> <th>303</th> <th></th> <th>3.78 - 2.56</th> <th>3.79</th> <th>8.8910</th>	250		8,75		5.28	5.5830	303		3.78 - 2.56	3.79	8.8910
331         16.10         8.24         211         5.31         5.24         + .07         306         12.36         4.89         - 2.20         8.89         8.73         + .16           234         15.96         8.19         2.11         5.31         5.32        01         307         13.14         5.33         - 3.09         3.64         3.80        16           355         15.96         8.19         2.11         5.31         5.24         + .07         308         14.25         5.53         - 3.22         3.62         3.55         + .07           356         16.81         8.50         2.39         5.42         5.42         .00         309         16.53         6.75         - 2.04         3.94         3.74         + .07           27         17.11         8.59         2.39         5.42         5.42         .00         309         16.53         6.75         - 2.04         3.94         3.74         + .16           28         18.72         9.91         4.87         6.45         6.59        13         310         17.94         7.02         - 3.70         3.48         3.77         + .11           39         16.09         9	251	14,66	7.59								3.55 + .09
256         15.94         8.26         2.13         5.31         5.32         - 01         307         13.14         5.33         - 3.09         3.64         8.90         - 16           256         16.31         8.50         2.31         5.31         5.24         + .07         308         14.25         5.53         - 3.22         3.62         8.83         + .07           257         17.11         8.59         2.17         5.33         5.2)         + .13         310         17.94         7.28         -3.14         8.63         3.70        07           26         14.72         9.91         4.87         6.45         6.59        14         311         18.17         7.02         - 3.70         3.48         3.37         + .11           390         16.09         9.86         5.34         6.66         6.77        11         312         18.19         6.60         4.23         8.37         + .11           320         16.49         9.59         4.58         6.32         6.37        06         313         15.59         5.77         - 7.55         2.60         2.71        11           321         16.49         9.59 <th< th=""><th></th><th>15.05</th><th></th><th>2,28</th><th></th><th></th><th></th><th></th><th></th><th></th><th></th></th<>		15.05		2,28							
x5         15.96         8.19         2.11         5.31         5.24         +.07         308         14.25         5.53         -8.22         3.62         8.53         +.07           x56         16.31         8.50         2.39         5.42         5.42         5.00         309         16.53         6.73         -2.94         8.74         +.20           x77         17.11         8.59         2.17         5.33         5.21         +.13         310         17.94         -7.28         -3.14         3.63         8.70        07           x86         18.72         9.91         4.87         6.45         6.59        14         311         18.17         7.02         -3.70         3.48         3.70         +.11           x80         18.09         9.86         5.34         6.66         6.77        11         312         18.19         6.60         -4.25         3.84         2.99         +.33           x80         18.09         9.61         5.22         6.60         6.52         +.08         313         15.59         5.64         -5.41         3.06         3.14        09           x81         18.09         4.58         6.32	253		8.24						4.89 - 2.20		
256     16.31     8.50     2.39     5.42     5.42     .00     309     16.53     6.75     -2.04     3.94     8.74     +.20       257     17.11     8.59     2.17     5.33     5.29     +.13     310     17.94    29    37     3.48     8.37     +.21       258     18.72     9.91     4.87     6.45     6.59    14     311     18.17     7.02    3.70     3.48     3.37     +.11       259     16.09     9.85     5.34     6.66     6.77    11     312     18.19     6.60     -4.23     8.34     2.99     +.33       250     16.09     9.61     5.22     6.60     6.52     +.06     313     15.59     5.64     -5.41     3.06     3.14    08       251     16.49     9.59     4.58     6.32     6.37    05     314     16.89     5.70     -7.55     2.60     2.71    11       262     17.09     9.02     3.16     5.72     5.58     +.14     315     17.50     6.9     -5.72     2.99     2.90     +.09       263     10.41     4.48     -1.04     4.23     4.10     +.13     316     18.10	254		8, 26	2.13		5.3201			5.33 - 3.09		3.8016
287     17.11     8.59     2.17     5.33     5.2)     + .13     310     17.94     7.28     - 3.14     8.63     3.70    07       286     18.72     9.91     4.87     6.45     6.59    14     311     18.17     7.02     - 3.70     3.48     3.37     + .11       399     18.09     9.86     5.34     6.66     6.77    11     312     18.19     6.60     - 4.25     3.34     2.99     + .33       280     16.09     9.61     5.22     6.60     6.52     + .08     313     15.59     5.64     - 5.41     3.06     3.14    08       281     16.49     9.59     4.68     6.32     6.37    05     314     16.89     5.70     - 7.56     2.60     2.71    11       382     17.09     9.02     8.16     5.72     5.56     + .14     315     17.50     6.19     - 5.72     2.99     2.90     + .09       383     10.41     4.48     -1.04     4.23     4.10     + .13     316     18.10     6.87     - 5.32     3.08     3.23    20	A5		8. 19			5.24 + .07			5.53 - 8.22		8.53 + .07
256     16.72     9.91     4.87     6.45     6.59    14     311     18.17     7.02     -3.70     3.48     8.37     +.11       259     18.09     9.86     5.34     6.66     6.77    11     312     18.19     6.60     -4.25     3.84     2.99     +.33       250     16.09     9.61     5.22     6.60     6.52     +.08     313     18.59     5.64     -5.41     3.06     3.14    08       261     18.49     9.59     4.58     6.32     6.37    05     314     16.89     5.70     -7.55     2.60     2.71    11       262     17.09     9.02     8.16     5.72     5.58     +.14     315     17.50     6.19     -5.72     2.99     2.90     +.09       265     10.41     4.48     -1.04     4.23     4.10     +.13     316     18.10     6.87     -5.32     3.08     3.23    20				2.89		5.42 .00			0.73 - 2.04		8.74 + .20
399     18.09     9.86     5.34     6.66     6.77    11     312     18.19     6.60     - 4.25     3.34     2.99     + .33       200     16.09     9.61     5.22     6.60     6.52     + .06     313     15.59     5.64     - 5.41     3.06     3.14    08       201     16.49     9.59     4.58     6.32     6.37    05     314     16.89     5.70     - 7.56     2.60     2.71    11       302     17.09     9.02     3.16     5.72     5.58     + .14     315     17.50     6.19     - 5.72     2.99     2.90     + .09       303     10.41     4.48     -1.04     4.23     4.10     + .13     316     18.10     6.87     - 5.32     8.08     3.28    20	207								7.00 - 3.14		
200 16.09 9.61 5.22 6.60 6.52 + .08 313 15.59 5.64 - 5.41 8.06 8.1408 201 16.49 9.59 4.58 6.32 6.3705 314 16.89 5.70 - 7.56 2.60 2.7111 202 17.09 9.02 8.16 5.72 5.58 + .14 315 17.50 6.19 - 5.72 2.99 2.90 + .09 205 10.41 4.48 -1.04 4.23 4.10 + .13 316 18.10 6.87 - 5.32 8.08 3.2320	235					6 77 - 11					
271 10.49 9.59 4.58 6.32 6.37 — .05 314 16.89 5.70 — 7.55 2.60 2.71 — .11 282 17.09 9.02 8.16 5.72 5.58 + .14 315 17.50 6.19 — 5.72 2.99 2.90 + .09 283 10.41 4.48 — 1.04 4.23 4.10 + .13 316 18.10 6.87 — 5.32 3.08 3.23 — .20				5.22		6.52 + .08				2 06	2 14 — (R
23 10.41 4.48 -1.04 4.23 4.10 + 13 316 13.10 6.87 - 5.32 8.08 3.23 - 20						6.3705					271 - 11
23 10.41 4.48 -1.04 4.23 4.10 + 13 316 13.10 6.87 - 5.32 8.08 3.23 - 20					5,72	5.58 + .14	315		6, 19 - 5, 72		2 90 + .09
			4.48	-1.04	4, 23	4.10 + .13	316	18, 10	6.87 - 5.32	8.08	3.2820
			4.87	-1.65	4.93	8.92 + .13	317	17.86	6.80 - 5.08	8.14	3.31 -0.17

## TRAIL HOUSE-Continued.

7-					p.		No.	_	_			p.	
No.	*	71	•	•	σ	<b>0−</b> C	No.	7	Ŧì	•	•	C	<b>∂</b> —C
	•	•	•	770470.	7794Th.	mm.		•	0	•	7747Ts.	17MTs.	17000
318	19, 28	7.49	-4.00	8.41	8,88	+0.03	848	18, 01	10.52	8,92	8,50	8,55	-0.0
319	18.83	7.10	-4.44	8,80	3, 21	+ .09	849	14,17	11.20	9.44	8, 81	8.81	.00
320	19.17	7.08	-5.56	8.08	8.05	02	850	14.86	11.50	9.25	8.69	8.86	17
321	18.68	7.04	-5, 89	2.95	8.22	<b>-</b> .27	851	14.30	10.85	8.54	8.29	8.41	1:
322	15.02	5.06	-6.22	2.88	2.88	.00	852	14.61	10.65	8.17	8.08	8.10	— .œ
228	15.74	5.48	-5.84	2.97	2.97	00	853	15.18	10.69	7.78	7.87	7.93	<u>⊸</u> .œ
324	16.79 17.44	5.98 6.50	-5.50 -5.89	3.04 8.06	8.00	+ .04 15	854 855	15, 29	10.61	7.66	7.81 5.11	7.83	<b>⊢</b> :0
325 326	17.96	6.83	-0.07 -1.71	8.23	3, 21 8, 29	- :06	856	9. 29 15. 91	5. 23 11. 72	1.57 9.18	8.66	5.13 8.70	⊏:ö
27	18,50	6.74	-6, 16	2.89	8.01	- :12	857	16.07	12.15	9.78	9.00	9.11	⊏:ĭi
328	18.84	6.52	-6.77	2.97	2.88	+ :09	858	15, 84	11.96	10,07	9.18	9.16	+ :à
329	18.41	6.58	-6.22	2.88	2.87	+ .01	859	16.14	11.53	8.47	8.24	8.43	i :i
เลก	14.67	8.62	8.94	6.04	6,11	07	860	17.46	11.08	6.70	7.81	7.48	- :i
331 332 333 334	15.44	8,60	8.54	5,88	5.88	+ .05	361	17.83	11.62	7.63	7.79	7.90	i
332	17.85	7.48	-1.17	4.19	4.09	+ ,10	862	17.56	10.41	5, 58	6.77	6.77	.0
333	18.11	7.16	-8.24	3.60	8.52	+ .08	363	17. 91	10.14	4.83	6.43	6, 89	+ .0
334	18.17	6.91	-8.56	8,52	8.27	+ .25	364	17.84	9. 92	4.87	6.22	6.19	+ .0
335 336 337	14.41	6.69	-0.26	4.48	4.49	01	365	10.62	4.87	-0.58	4.40	4.87	+ .0
38	15.42	6.82	-1.25	4.17	4.21	04	866	10.62	4.91	-0.29	4.47	4.40	+ .0
887	15.61	7.05	-1.16	4.20	4.84	14	367	18.10	10.99	6.09	7.02	7.16	<b>├</b> . 1
338 339	15.64	7.05 7.43	-1.10 -0.28	4.22	4.33 4.52	11	368	18.79	9.65	2, 41	5.46	4.57	١. ا
340	16.08 16.37	7.26	-0.81	4.31	4. 25	04 + .06	369	18.81	10.56	4.67 1.72	6.35 5.17	6.65 5.21	3 0
341	16.65	6.61	-3.53	8.52	3.55	- :08	370 371	13, 28 13, 78	7.06 7.33	2.13	5. 30	5.28	+ :0
342	17.17	7.00	-2.72	8.74	3.74	03	872	14,41	7.61	1.78	5.19	5.27	0
343	16.61	6, 10	- <b>1</b> .64	8.40	8.17	+ .23	873	14, 91	7.74	1.94	5. 25	5.23	+ :ŏ
344	16.76	6.58	-8.28	8.59	8.53	+ .06	874	15.50	8. 83	2,69	5.53	5.56	<u> </u>
B45	13.72	10, 22	8.09	8.04	7.99	+ .05	375	15, 52	8.64	8. 21	5.74	5.81	ŏ
346	18, 17	10.50	8.78	8.42	8.48	06	876	15.85	8.72	8.01	5.66	5.77	i
347	12,85	10,46	8,94	8.51	8.74	-0.23	377	16.59	8.99	3,08	5.69	5.76	-0. ō

#### PIKE'S PEAK.

878	8.78	2.38	-8.90	8.43	8.47 -0.04	420	احما	0.00	-1.09	4, 22	4.18 +0.04
879	4.70	1.68	-1.24	4.17	4.2306	421	5.73 5.04	2.09 1.70	-1.56	4.07	4.1306
890	6.71	1.72	-8.06	8.65	8.64 + .01	422	7.06	1.83	-3.22	8.61	8.61 .00
381	7.97	2.67	-2.03	8.94	8.90 + .04	423	8,70	3, 61	-0.64	4.86	4.32 + .04
382	6,21	8.00	0, 11	4.60	4.6808	424	9.73	4. 49	0.65	4.78	4.67 + .11
383	6.40	8.27	0.54	4.75	4.8005	425	8.19	4.24	0.93	4.88	4.9709
384	6.14	8.44	1.09	4.94	5.0208	426	9.13	4.55	1.01	4.91	4.90 + .01
385	7.09	3.83	1.28	5.01	5.00 + .01	427	9.04	4.44	0.83	4, 85	4.8601
386	6.45	8.71	1.71	5, 16	5.11 + .05	428	8.37	4, 47	1.61	5, 13	5.07 + .06
387	6.76	4, 19	2.08	5.28	5.8709	429	8,56	4.39	1.44	5.07	4.97 + .10
388	6.85	3, 80	1.58	5.12	5.05 + .07	430	7.74	4.11	1.28	5.01	5.00 + .01
389 ,	6.85	8.73	1.51	5.09	4.99 + .10	431	7.36	8.78	1.21	4.98	4.89 + .09
390	6.65	8.60	1.15	4.96	4.9701	432	8.21	-1.87	<b>-7.28</b>	2.66	2.75 — .09 2.91 + .03
391	6.50	3.58	1.85	5.03	5.00 + .03	433	8.41	-0.98	-5.93	2.94	2.91 + .03
392 393	27.88	12.94 11.87	5, 20	6.60	6.6505	434	4.05	-0.63	-6.91	2.78	2.9421
894	23.47	11.63	4.41 4.81	6, 24 6, 42	6.48 — .24 6.54 — .12	435	6.81	0.87	-7.20	2.67	2.7806
395	23.03	11.60	5.03	6.52	6.54 — .12 6.63 — .11	436	9.28	2. 20	-4.59 -4.33	3, 26 3, 31	8.24 + .92 8.30 + .01
396	22.63	11.39	4.95	6.48	6.5709	437 438	10.18 9.63	2.77 2.62	1.84	8,31	8.30 + .01 3.3605
897	28.08	18.06	5.07	6.54	6.54 00	439	9. 63	1.76	-6.10	2,91	2.83 + .08
398	28.57	18,20	4.78	6.41	6.5312	440	10.62	3.17	-8.94	3.42	8.4604
899	81.26	14,60	6, 23	7.08	7.2012	441	10.81	2.83	-4.83	8, 20	3.13 + .07
400	30.78	14.83	7.23	7.58	7.5901	442	10.95	2.56	-5.92	2.95	2.91 + .04
401	26.94	18.00	5, 64	6.80	6.8404	443	12.62	4. 24	-3.89	3,56	3.6004
402	6.12	1.49	-2.60	8.78	8.67 + .11	444	18.47	5. 18	-1.67	4.05	4.05 .00
403	7.22	2,72	-1.44	4,11	4.1807	445	12.59	4.43	-2.49	3, 81	8.75 + .96
404	7.44	8.02	-1.00	4,25	4.8207	446	11.61	8, 89	-4.08	3,38	3.30 + .08
405	8.22	8.41	-0.65	4, 36	4.86 .00	447	7.84	0.82	-6.87	2.85	2.85 .00
406	8.85	4.59	1.25	5,00	5.0202	448	7.87	1.30	-5.80	2.97	3.0205
407	9.22	4.99	1.78	5.17	5,2104	449	10.39	2, 94	-3.98	8.42	3.86 + .06
408	9.01	5.10	2.24	5.36	5.86 .00	450	9.13	2.08	-4.95	3.17	8.11 + .08
409	9.44	5.13	2.10	5.81	5.25 + .06	451	12.08	8.44	-3.94	3.42	3.20 + .22
410 411	8.48 7.89	4.71	1.92	5. 24	5.22 + .03 5.02 + .01	452	12,50	8,94	-8.75	8.47	3.43 + .04
412	8.83	4.89	1.85	5.08	5.02 + .01 4.88 .00	453	13, 26	4.24	-3.69	3.48	3.41 + .07
418	8.10	1.40	1.61	4.88 5.18		454 455	12.70	4.07	-3.58 -2.97	3.51	3.5605
414	8.42	4.22	0.98	4.88	5.11 + .02 4.88 .00	456	12.13 11.39	4.07 8.63	-2.97 -8.15	3. 57 3. 63	3.68 + .04 3.54 + .09
415	6.89	2.59	-1.28	4.16	4.1903	457	9.58	3.89	-0.72	4.34	4.29 + .06
416	7.11	2.22	-2.27	3.87	8.9205	458	10.02	5. 23	1.82	5, 20	5.15 + .05
417	8.72	3.38	-1.25	4.17	4.1801	459	8.49	5.03	2.41	5.42	5.4604
418	6,85	2.50	-1.55	4.08	4.1507	460	7.91	5. 28	3, 20	5.74	5.84 — .10
419	6, 22	2,29	-1.09	4.22	7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7	461	8.80	5, 27	2.72	5.54	5.58 -0.04
39	·										

Note.—The experiments 392-401, inclusive, were made in a room artificially heated.

PIKE'S PEAK-Continued.

					p.							p.	
No.	•	n		•	С	<b>8</b> −0	No.	, , , , , , , , , , , , , , , , , , ,	71	8	ð	С	<b>ø</b> − <i>c</i>
\$11 \$28 \$34 \$34 \$35 \$35 \$37 \$30 1	9.122.067.37.112.06.09.77.112.06.09.77.112.06.09.77.112.06.09.77.112.06.09.77.112.06.09.77.112.06.09.77.112.09.09.09.09.09.09.09.09.09.09.09.09.09.	5.66.80 5.760 6.813751 6.089 6.513751 6.089 6.513751 6.089 6.513751 6.089 6.513751 6.089 6.513751 6.089 6.513751 6.089 6.513751 6.089 6.513751 6.089 6.513751 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089 6.089	2 278 8.206 8.206 8.206 8.206 8.206 8.206 8.206 8.206 8.206 8.206 8.206 8.206 8.206 8.206 8.206 8.206 8.206 8.206 8.206 8.206 8.206 8.206 8.206 8.206 8.206 8.206 8.206 8.206 8.206 8.206 8.206 8.206 8.206 8.206 8.206 8.206 8.206 8.206 8.206 8.206 8.206 8.206 8.206 8.206 8.206 8.206 8.206 8.206 8.206 8.206 8.206 8.206 8.206 8.206 8.206 8.206 8.206 8.206 8.206 8.206 8.206 8.206 8.206 8.206 8.206 8.206 8.206 8.206 8.206 8.206 8.206 8.206 8.206 8.206 8.206 8.206 8.206 8.206 8.206 8.206 8.206 8.206 8.206 8.206 8.206 8.206 8.206 8.206 8.206 8.206 8.206 8.206 8.206 8.206 8.206 8.206 8.206 8.206 8.206 8.206 8.206 8.206 8.206 8.206 8.206 8.206 8.206 8.206 8.206 8.206 8.206 8.206 8.206 8.206 8.206 8.206 8.206 8.206 8.206 8.206 8.206 8.206 8.206 8.206 8.206 8.206 8.206 8.206 8.206 8.206 8.206 8.206 8.206 8.206 8.206 8.206 8.206 8.206 8.206 8.206 8.206 8.206 8.206 8.206 8.206 8.206 8.206 8.206 8.206 8.206 8.206 8.206 8.206 8.206 8.206 8.206 8.206 8.206 8.206 8.206 8.206 8.206 8.206 8.206 8.206 8.206 8.206 8.206 8.206 8.206 8.206 8.206 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#### PIKE'S PEAK-Continued.

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110.	•	n	0,	•	C	<b>∂</b> -C	No.	*	n		ð	C	<b>→</b> c
620 621 623 624 625 626 627 628 629 630	81. 26 80. 69 29. 65 29. 45 29. 62 28. 08 27. 30 24. 94 22. 44 22. 55 22. 72	17. 15 16. 73 17. 72 17. 38 16. 53 17. 20 17. 40 17. 20 16. 65 16. 96 17. 28	9.43 9.82 11.61 11.05 9.58 15.54 12.63 12.92 18.54 13.95 14.50	mm. 8.80 8.73 10.17 9.80 8.89 10.12 10.87 11.08 11.54 11.84 12.27	mm. 8.76 8.44 10.19 9.81 8.62 10.15 10.73 11.44 11.78 12.21 12.46	mm. +0.04 + .29 02 01 + .27 03 + .14 36 19 37 -0.19	631 632 633 634 635 636 637 638 639 640	22, 97 22, 61 22, 24 22, 02 15, 58 16, 06 26, 10 25, 51 24, 48 25, 17	o 17. 13 16. 84 16. 24 13. 28 13. 44 19. 65 18. 41 17. 17	14.39 13.36 13.25 13.22 11.67 11.81 17.00 15.42 13.73 14.30	mm. 12, 19 11, 41 11, 82 11, 90 10, 20 10, 90 14, 40 13, 02 11, 68 12, 12	mm. 12.14 11.27 11.51 11.37 10.41 10.41 14.88 12.85 11.59 12.01	-0.00 + .14 19 07 21 + .02 + .11 + .00 + .11

## WASHINGTON (SIMULTANEOUS EXPERIMENTS).

1	24.22	20.18	18.13	15.46	15, 52 -0.06	1	24.04	20.13	18, 12	15.45	15,52 -0
۱	24. 41	20, 17	17.78	15.12	15.4129	2	24.45	20. 36	18, 11	15.44	15.68
	24.74	20,34	17.95	15, 28	15.5128	8	24.69	20.46	18. 21	15.53	15.72
	24.67				15.5128			20. 10			15.72 — 15.61 —
		20.33	17.96	15.29	15.5324	4	24.58		18.18	15.46	13.01
9	24.96	20.37	18,02	15, 35	15.4409	5	24.85	20, 43	11.86	15.60	15.60
П	24.68	20,45	18, 23	15.55	15.7217	6	24.55	20.42	11.87	15.90	15.73 +
	19.93	15.28	11.70	10.23	10.5532	7	19.96	15.14	9, 99	10.84	10.37 —
3	20.33	15, 14	11, 28	9.94	10 18 - 24	8	20, 24	15.08	10.28	10.01	10.13
1	19, 91	14, 42	10, 26	9, 30	9.44 - 14	9	19.53	13,98	11.03	9.13	9.06 +
)	19.89	14, 43	10, 21	9.27	9.4720	10	19.74	14.29	11. 26	9.81	9.36 —
	20,70	15, 10	11,07	9.81	9 94 - 13	11	20.58	14.95	11.97	9.78	9.82 —
2	20,93	15, 41	11.31	9.97	10.2326 10.4319 10.4715	12	20.81	15.22	11.95	9.94	10.03 —
	20,98	15,58	11.71	10.24	10.4319	13	20.86	15.40	12.06	10,41	10.25 +
1	21.02	15.62	11.83		10, 43	14	20.91	15.50	12.36	10, 40	10.87 +
1	21.00	15,72		10.32	10.4715				18.28	10, 47	10.45 +
			12,00	10.43	10.6017	15	20.89	15.56			
,	20.96	16.06	12.37	10.69	11.0839	16	20.89	15.70	18.58	10.67	10.63 +
	20.89	16,91	14.11	11.97	12.2932	17	20.73	16.68	14.56	12.82	12.05 +
3	21, 17	17.22	14.51	12,28	10.47 15 10.60 17 11.08 39 12.29 32 12.61 28 13.21 41 13.23 33	18	21.11	17. 15	14.83	12.53	12.51 + 12.59 -
	21, 32	17.28	14.57	12.33	12.6128	19	21.47	17.21	14.78	12, 45	12.59 —
•	21.50	17.77	15, 17	12, 80	13, 2141	20	21.48	17.60	15.80	12,92	13.(1
	21,54	17.79	15.28	12,90	13.2333	21	21.50	17.63	15. 26	12.88	18.02 — 17.86 — 17.26 — 16.79 —
	26, 61	22, 29	20, 33	17,72	17.8008 17.8534 16.9021	22	26.61	22.33	20, 44	17.84	17.86 -
	27, 27	22, 22	19.67	17.01	17.8534	23	27.35	22, 19	19.74	17.09	17.26
i	28.13	22, 21	19.36	16, 69	16,9021	24	28.04	22, 12	19.85	16,68	16.79 -
	28, 28	21, 85	18.86	16, 15	16.2005	25	28.38	21.61	18.75	16.07	16.09 -
,	29, 35	20, 99	16, 48	13, 93	16.2005 14.2330	26	29.30	20.80	16.78	14.20	13.94 +
				10.50	14, 2300						12.61
	29, 87	20, 22	14.90	12,59	12.7112	27	29.85	20.15	15.25	12.88	
1	30.08	19.92	14.08	11,94	DE, 12   10	28	29,84	19.94	14.30	12.12	
•	30.06	19,80	13, 75	11.69	111.94  20	29	29.94	19.69	13, 94	11.84	11.63 +
)	30.17	19,58	13.51	11.51	11.5403 11.5507	80	30.09	19.52	13.55	11.54	11.48 +
l	30.02	19.54	13.47	11.48	11.5507	81	29.94	19.48	13.39	11.43	11.50 —
2	************	*********				82	22, 91	16.85	18, 15	11.25	11.19 +
3						83	22.78	16.70	13.05	11.17	11.00 +
ı						84	22, 63	16, 39	12,55	10.82	10.70 +
5	22, 89	16.70	12,50	10.78	10.99 — .21 11.02 — .19 10.95 — .14 13.72 — .11 13.42 + .05	35	22.89	16, 70	12,48	10.76	10.99
3	22,77	16.67	12.58	10.83	11.0219	36	22, 80	16.70	12, 70	10.92	11.04 -
1	22, 91	16.67	12,56	10, 81	10.9514	37	22.88	16.70	12,70	10.92	10 Co. l.
3	23, 08	18.64	16.11	18.61	13 72 - 11	38	23, 19	18,64	16,06	13.56	13.66
•	24, 36	18, 87	15.94	13, 47	13 42 4 05	39	24, 20	18.84	15.88	13, 41	13.46 -
,	24.13	18.80	15.86	18, 40	10.42 7 .00	40	23.94	18.61	15.50	13.09	13.21
ĺ	24. 20	18.86	16.02	13.53	13.43 — .03 13.49 — .04		23.93		15.70	13, 25	32 46
		18.78			10.4704	41		18.75		13. 23	13.44
2	23. 91		16.00	13.51	18.51 .00	42	24.00	18.76	15, 67	10.23	10.34
•	23.86	18.82	16.06	18.57	13.60 — .03 13.50 — .04	43	23.88	18.80	15.78	13.82	13.44 — 13.56 — 13.54 —
ı	24.22	18.89	15.94	13.46	13.5004	44	24.10	18,86	15.85	18.38	13.54
i	20.50	17.16	15. 31	12.93	12.84   <b>+ .</b> 09	45	20.50	17.08	15.83	12.54	12.73
,	21.67	17.66	15.61	13.18	12.99 + .19	46	21.61	17.66	<b>1</b> 5, 15	12.80	13.01
7	22.22	17.89	15.55	13, 13	13.04 + .09	47	22, 44	17.92	15.89	13.00	12.97 +
1	23, 35	18.33	15.46	13,06	13 12 - 06	48	23, 88	18.46	15.41	13.01	18,05
1	23.84	17.56	13.91	11.82	11.95 — .13	49	23, 43	17.47	14.00	11.88	11.82 +
	23,50	17.24	13. 31	11,36	11.95 — .13 11.46 — .10	50	23.58	17. 24	13.57	11.55	11.42
	23.67	17.06	12.59	10.84	11 11 - 27	51	23.76	17.02	13.20	11.28	11.01
	23.71	16.89	12.50		170.04		23.76	16.94	12.58	10.83	
	60.71			10.78	10.8406	52					10.90
	27.70	18.47	12.76	10.96	11.11 — .27 10.84 — .06 11.11 — .15 11.28 — .16	53	28, 28	18.80	13.02	11.15	11.81
1	27.81	18.62	12.98	11.12	11.28 — .16	54	28.41	18.78	12.94	11.09	111.22 -
,	19.00	12.80	7.59	7.77	7.8609	55	19.79	13.01	7.28	7.61	7.71
1	22.68	14.83	9.06	8.58	7.8609 8.57 + .01	56	22, 83	14.83	8,80	8.48	8.49 -
٠,	28.00	15.01	9.19	8, 66	8.63   + .08	57	22, 97	14.93	8, 89	8.49	8.55
3	23.16	15.08	9.39	8.78	8.65 +0.13	58	23. 21	15.05	9.12	8.62	8.58 +0
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MASSA	CHUSETTS	AND W	ASHINGTON	(HAZEN).

Ko.			8		p.		No.	_	_	8		p.	
NO.	7	Ħ		3	C	<i>8</i> − <i>C</i>	No.	7	71	•	•	C	0-C
1 2 3 4 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 22 23 * * 4 25 26 27	20,732 19,069 17,39 26,617 16,222 7,78 4,44 1,448 4,94 6,200 8,811 1,156 -1,22 2,116 -2,25 -2,25 -2,25 -1,24	0 9.56 8.67 10.61 17.28 10.06 2.39 8.17 0.56 2.50 0.44 1.28 2.50 2.94 2.11 -1.28 -0.50 -1.39 -1.39 -1.44 -2.78 **	0 2.44 - 1.83 - 2.17 0.67 11.22 - 0.23 - 3.39 - 6.94 - 6.94 - 6.94 - 6.94 - 6.95 - 6.95 - 6.95 - 6.95 - 6.95 - 6.95 - 6.95 - 6.95 - 6.95 - 6.95 - 6.95 - 6.95 - 6.95 - 6.95 - 6.95 - 6.95 - 6.95 - 6.95 - 6.95 - 6.95 - 6.95 - 6.95 - 6.95 - 6.95 - 6.95 - 6.95 - 6.95 - 6.95 - 6.95 - 6.95 - 6.95 - 6.95 - 6.95 - 6.95 - 6.95 - 6.95 - 6.95 - 6.95 - 6.95 - 6.95 - 6.95 - 6.95 - 6.95 - 6.95 - 6.95 - 6.95 - 6.95 - 6.95 - 6.95 - 6.95 - 6.95 - 6.95 - 6.95 - 6.95 - 6.95 - 6.95 - 6.95 - 6.95 - 6.95 - 6.95 - 6.95 - 6.95 - 6.95 - 6.95 - 6.95 - 6.95 - 6.95 - 6.95 - 6.95 - 6.95 - 6.95 - 6.95 - 6.95 - 6.95 - 6.95 - 6.95 - 6.95 - 6.95 - 6.95 - 6.95 - 6.95 - 6.95 - 6.95 - 6.95 - 6.95 - 6.95 - 6.95 - 6.95 - 6.95 - 6.95 - 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13. 15 - 10. 83 - 1	- 6,06 - 7,89 - 6,06 - 3,78 - 7,00 - 6,56 - 6,89 - 21,00 - 21,00 - 22,07 - 21,01 - 21,01 - 10,24 - 14,56 - 19,00 - 14,17 - 15,72 - 17,78 - 17,78 - 17,78 - 17,78 - 17,78 - 17,78 - 17,78 - 17,78 - 17,78 - 17,78 - 17,78 - 17,78 - 17,78 - 17,78 - 17,78 - 17,78 - 17,78 - 17,78 - 17,78 - 17,78 - 17,78 - 17,78 - 17,78 - 17,78 - 17,78 - 17,78 - 17,78 - 17,78 - 17,78 - 17,78 - 17,78 - 17,78 - 17,78 - 17,78 - 17,78 - 17,78 - 17,78 - 17,78 - 17,78 - 17,78 - 17,78 - 17,78 - 17,78 - 17,78	mm. 2.92 2.53 2.93 2.72 2.74 2.74 2.74 2.74 2.74 2.74 2.11 1.49 1.49 1.54 1.16 1.16 1.16 1.16 1.29 1.29 1.22 1.29 1.29 1.29 1.20 1.20 1.20 1.20 1.20 1.20 1.20 1.20	mm. 2.95 2.58 2.44 2.71 2.45 1.09 1.07 1.13 1.30 2.15 1.22 1.20 1.30 1.30 1.50 1.50 1.50 1.50 1.50 1.50 1.50 1.5	mm 0.03

*Wet bulb covered with ice.

From the pyschrometric formula, equation (1), we get:

$$A = \frac{p_1 - p}{P(\tau - \tau_1)}$$

From this, with the data given in the preceding table, since  $p_1$  and p are the maximum vapor tensions corresponding to  $\tau_1$  and  $\delta$  respectively, we get the value of A, which satisfies each experiment.

The most probable value of AP from a number of experiments made at the same station, by the principle of least squares, is sensibly

(3) 
$$AP = \frac{\sum (p_1 - p) (\tau - \tau_1)}{\sum (\tau - \tau_1)}$$

since in a number of experiments the average value of P can be used without sensible error. In combining, however, the experiments made at different altitudes we must put

(4) 
$$A = \frac{(\sum p_1 - p) \ r - r_1}{\sum P(r - r_1)}$$

But in this the average value of P can be used in all the experiments of any one station. From the data given by the experiments the values of  $(p_1-p)$   $(\tau-\tau_1)$  and of  $\tau-\tau_1$  were computed for each experiment. In this the revised table of vapor tensions, published by the authority of the International Committee on Weights and Measures, has been used.

Since the value of A, by theory, is in a very small measure a function of  $\tau_1$ , the expariments at Colorado Springs have been divided into seven groups according to the velues of  $\tau_1$ , from which the following table of results have been obtained for each group, of which the average value of  $\tau_1$  is that contained in the second column. The values of AP in the last column are obtained from those of the two preceding columns by means of (3).

Number of ex- periments.	TI	$\Sigma(P_1-p)( au- au_1)$	Z(7-71)	AP
50	1.0	322. 6	807.6	0. 3994
59	4.6	1266. 9	8138.4	0. 4087
70	7.4	2639. 9	6573.1	0. 4016
16	10.0	757. 1	1880.1	0. 4027
5	18.5	179. 6	423.9	0. 4237
51	16.5	2004. 4	4947.5	0. 4052
88	18.9	1048. 6	2505.9	0. 4184

But few experiments fall into the middle groups, because part of the experiments were made in the early part of spring, before the observer ascended the mountain to the Trail House and Pike's Peak, and the balance, in order to get the other extreme of temperatures, after he returned in July. The relative weights of these determinations of AP are as the numbers under the heading,  $\Sigma(\tau-\tau_1)$ .

9. Regarding AP now as a function of the first power of  $r_1$ , the part depending on  $r_1$  being very small, we can put:

$$AP = 0.4 + P\delta A_0 + e\tau_1$$

in which

$$A_0P = 0.4 + P\delta A_0$$

is the value of AP where  $\tau_1=0$ , and in which  $\delta A_0$  is a small correction of  $A_0$  in the first assumed value of  $A_0P=0.4$ .

From (5) we get with the values of AP and of  $\tau_1$  in the preceding table, seven equations of condition for determining the most probable values of the two quantities,  $\delta A_{\bullet}$  and  $\epsilon$ .

$$P\delta A_0 + 1.0e = -.0006$$
  
 $P\delta A_0 + 4.6e = +.0037$   
 $P\delta A_0 + 7.4e = +.0016$   
 $P\delta A_0 + 10.0e = +.0027$   
 $P\delta A_0 + 13.5e = +.0237$   
 $P\delta A_0 + 16.5e = +.0052$   
 $P\delta A_0 + 18.9e = +.0184$ 

Giving these equations weights in proportion to the preceding values of  $\Sigma(\tau-\tau_1)$  and solving by the method of least squares, we get

$$P\delta A_0 = -0.0027 \pm 0.0008$$
(7) 
$$e = 0.00075 \pm 0.000069$$

Hence we get by (6)  $A_0P = 0.3973 \pm 0.0008$ . The estimated average value of P for all the experiments at Colorado Springs is  $611^{\text{mm}}$ . We therefore get

(8) 
$$A_0 = 0.00065 \pm 0.0000013$$

Dividing (5) by P=611 we get, by means of (6), (7), and (8)

(9) 
$$A = A_0 + \frac{e}{611} r_1 = 0.000650 (1 + 0.0019 r_1)$$

10. The part in this expression of A, depending upon  $\tau_1$ , it is well known, arises from a similar term in the expression of the latent heat of water. This, by the former expression of latent heat used in Regnault's formula, is 1:610 = 0.00164. By the expression of the latent heat of water as determined by Regnault, and now used, this coefficient is 0.695:606.5 = 0.00115. This is considerably less than the coefficient above, obtained from the experiments at Colorado Springs, and from the probable error in (7), and consequently of this coefficient, it would seem that the true value cannot be so small. But in the method of obtaining probable errors it is assumed that the error in each individual observation is as liable to be in error in the one direction as the other. The determination of this coefficient from the experiments depends in a great measure upon a comparison of the results obtained from the experiments at Colorado Springs in the

spring with those from the experiments made in midsummer after the return from Pike's Peak, and we cannot assume that during this time there may not have been some slight change in the instruments or the method of observing which caused a slight change in the relation between the results obtained at the two seasons which was constant in the same direction. It would require a very small change of this sort to cause the difference between the theoretic value of the constant above and that obtained from the experiments, since we are here dealing with a very small term in which the difference between the two values is somewhat of the order of the probable error in its determination from the experiments. For the present, therefore, until further research on the subject, it is perhaps safest to use the coefficient given by Regnault's expression of the latent best of water, since we know that this is a real effect which must come into the formula; but still we cannot be sure that in the theory, based upon an imperfect and approximate application of the diffusion theory of gases, there may not be some small modifying effects not taken into account which would change the value of this coefficient in the one direction or the other. We shall therefore put

(10) 
$$A = A_0 (1 + 0.00115 \tau_1)$$

11. With the data obtained from the 100 experiments at the Trail House, the estimated average value of P being 550 mm, we get from (3)

(11) 
$$A = \frac{3798}{550 \times 10297} = 0.000671$$

The values of  $\tau_1$  in these experiments are confined within a small range and so all the experiments are included in one group. This value corresponds to the average of  $\tau_1$  6°.9.

In the same manner we get from the 170 experiments on Pike's Peak, the estimated average value of P being  $461^{\mathrm{mm}}$ ,

$$A = \frac{2225}{461 \times 7325} = 0.000668$$

This corresponds to an average value of  $r_1 = 4^{\circ}.4$ .

From 55 of the 58 experiments made by Marvin at Washington, with an average barometric pressure  $P=763^{\rm mm}$ , we get from (3)

(13) 
$$A = \frac{1114}{763 \times 2116} = 0.000690$$

corresponding to an average value  $r_1 = 17^{\circ}.8$ .

From Hazen's 58 simultaneous experiments, made under the same conditions, we get from (3)

$$A = \frac{1155}{763 \times 2264} = 0.000669$$

From the 16 experiments made by Hazen in Massachusetts, with  $r_1 > 0^{\circ}$  and an estimated average of  $P = 760^{\text{mm}}$ , we get

$$A = \frac{359}{760 \times 722} = 0.000654$$

corresponding to an average value of  $r_1 = 5^{\circ}.4$ .

12. The following is a summary of the results obtained at the several stations:

Station.	Number of exper- iments.	P	τι	4	40
Colorado Springs	289 160 170	mm. 611 550 461	9.1 7.0 4.4	0.000671 668	0, 000 <b>6</b> 50 666 664
Marvin Hazen Hazen	98	763 763 760	17.8 17.8 5.4	690 669 654	676 656 650

With the values of A and  $\tau_1$  that of  $A_0$  has been obtained from (10), except in the case of Colorado Springs, which has been treated in a different manner by dividing the experiments into different groups with reference to the values of  $\tau_1$ , in order to obtain a verification of the coefficient of  $\tau_1$  in (10). The relative weights in these determinations of  $A_0$  are as the denominators in the preceding expressions of A. Considering the great range of altitude of the stations from sea level up to the top of Pike's Peak, the values of  $A_0$  obtained at the several stations agree with one another remarkably well, for the greatest difference of any of them from the average corresponds to only  $0.15^{\rm mm}$  of vapor tension in the formula (1), with a value of  $\tau - \tau_1 = 10^{\circ}$ .

From the combination of all the 751 experiments we get, using (4) instead of (3) in this

(16) 
$$A = \frac{16899}{25318700} = 0.000667$$

corresponding to an average value for all the experiments of  $r_1 = 8^{\circ}.9$ . With these values of A and  $r_1$  (10) gives

$$A_0 = 0.000660$$

as the most probable value deduced from all of the experiments. If this last reduction had been made by means of (9) instead of (10) we should have  $A_0 = 0.000656$ . It is with this value that the value of  $A_0$  in (8) should be compared in comparing the constant deduced from the experiments at Colorado Springs with the morphable value deduced from all. It is this latter value which should be used if the coefficient of  $r_1$  in (9) is adopted. In either case the psychrometric formula would agree for the value of  $r_1 = 8^\circ.9$ .

13. From the whole number of experiments made by Marvin with Regnault's hygrometer, 677 in number, we get in the same manner as in the preceding examples,  $A_0 = 0.000661$ . From the 74 experiments made by Hazen, in which the temperature of the wet bulb was above freezing, and in which Alluard's hygrometer was used, we get in like manner  $A_0 = 0.000654$ . The average value of  $\tau - \tau_1$  in these latter experiments is 6°.1. Hence, using the difference between these values of  $A_0$ , an average decrease of  $0.00007 \times 760$ .  $\times$ 6°.1 =  $0.032^{\rm mm}$  in the indications of Alluard's hygrometer reduces them to the same as those given by Regnault's hygrometer, if we suppose that the readings of the two psychrometers are precisely the same. But from the 55 simultaneous comparative experiments of Marvin and Hazen we get by means of a differential formula and the differences between their readings, the average difference of the vapor tensions (Marvin — Hazen), equal  $0.040^{\rm mm}$ . Hence we shall have the average difference of the vapor tensions given by the hygrometers (Alluard — Regnault) equal  $0.072^{\rm mm}$ .

Sworykin found from his comparative experiments the difference between the vapor tensions given by Alluard's and Swackhöffer's volume hygrometer (Alluard—volume hygrometer) equal 0.10^{mm}. Hence it would seem that the indications of Regnault's hygrometer and the volume hygrometer are very nearly the same, and that the difference between the indications of Alluard's hygrometer and those of either of the others is very small.

14. The estimated velocity of whirling of the psychrometer in the experiments was 25 feet per second.

The thermometers were cylindrical, of the following dimensions: Dry-bulb, No. 979. length 18^{mm}, and diameter 3.8^{mm}; wet-bulb, No. 85, length 23^{mm}, and diameter 4^{mm}, approximately.

From numerous comparative experiments it is shown that with a velocity of 12 feet per second and upwards there are no sensible differences in the depressions of the wetbulb temperatures  $t-\tau_1$ , either for different sizes or shapes of the bulbs or for different velocities of whirling. The following table contains the results in Fahrenheit degrees of twenty-one experiments made at Colorado Springs, with an estimated velocity of whirling of 25 feet per second:

Cylin	drical bulbs.	ì	Spherical bulbs.						
Dry, No. 979.	Wet, No. 85.	7-71	Dry, No. 727.	Wet, No. 721.	TT1				
•	3	•	•	•	۰				
62, 83	52, 55	10, 28	63. 10	52.32	10.78				
70.75	49, 92	20.88	70.92	49.87	21.05				
68. 18	48.65	19.48	68. 20	48.54	19.66				
61. 15	50.04	11.11	61.86	50.02	11.81				
57.42	49.12	8.30	57.49	49.24	8, 25				
61.82	49.98	11.89	62.11	49.74	12,87				
61.83	49.79	11.54	61.51	49.71	11.80				
63, 24	52.15	11.09	63.48	52.12	11.86				
64.62	52.08	12.59 11.39	64.73 63.22	52.07 51.65	12.66 11.57				
63, 03 62, 72	51.64 50.72	12.00	62.82	50.75	12.07				
63.24	50. 83	12.41	63.18	50.87	12.31				
62.83	50.50	11.83	62, 42	50.54	11.88				
70.66	47.56	23. 10	70.66	47.48	23, 18				
70.89	47.17	28. 22	70.80	47.31	23, 49				
70.38	46.65	23.73	70.30	46, 54	23, 76				
71, 20	47.58	23,62	71.12	47.44	23,68				
71.38	47.20	24, 18	71.38	47.16	24, 22				
74.42	48.96	25, 46	74,06	48, 52	25, 54				
74, 17	49.88	24.79	74.42	49.36	25, 06				
74.99	49.47	25, 52	75.04	49. 42	25, 62				
66, 68	49.61	17.07	66.78	49.56	17.22				

Each one of the temperatures in this table is the average of about ten readings of the thermometer, all being read forward and back alternately in such a manner as to make the averages in each experiment the same as those of simultaneous readings. It is seen that the temperature depression  $r-r_1$  upon the whole, and mostly in each experiment, contrary to what we would expect, is smaller in the cylindrical than in the spherical bulbs, but the amount is very small and may be due to instrumental errors. It is seen that it arises mostly from the differences in the readings of the dry-bulb thermometers, only one-third of it being due to differences in the readings of the wet-bulb thermometers. The diameter of the spherical bulbs was  $r_0$  of an inch; the dimensions of the cylindrical ones, as given above.

The following table contains the depressions  $r-r_1$ , in two sets of three experiments each, made at Colorado Springs with the same cylindrical thermometers, first with the psychrometer still, and then with estimated whirling velocities per second, as given:

	First set.		8	•	
Still.	8 feet.	25 feet.	Still.	12 feet.	25 feet.
o 18.07 12.93 18.51	o 18, 80 13, 96 14, 53	0 13.85 13.95 14.74	8. 49 9. 76 19. 82	9, 22 9, 97 21, 61	9, 12 10, 09 21, 53
18, 17	14.10	14.18	12,69	13, 60	13.58

These experiments were made in a room not entirely closed, but in which there was but little agitation of the air. The following were made under the same conditions at Pike's Peak:

Still.	12 feet.	25 feet.
0 11.21 9.17 8.61	0 12,02 10,89 10,46	0 12.04 10.84 10.44
9.66	11.12	11.11

In each of these experiments the depressions of the wet-bulb temperatures  $r-r_1$ , are greater with the psychrometer whirled than with it not whirled, and on the average the depression is a very little greater with a velocity of 25 feet than with a velocity of 8 feet, but there does not seem to be any sensible difference in velocities of 12 feet and 25 feet per second. In the last two tables, as in the preceding one, the numbers are the averages from ten readings of the instruments.

15. From all of the preceding experiments we may infer that with cylindrical bulbs the maximum depression of the wet-bulb temperature is reached sensibly with a velocity of whirling of 10 feet per second, and that with a velocity of 25 feet, at least, there is no sensible difference in this depression between cylindrical and spherical bulbs, and that the difference most probable vanishes sensibly at 10 feet per second. If so, the same value of the constant A in the psychrometric formula can be used for all shapes and sizes of thermometer bulbs, and for all velocities of ventilation of 10 feet or more per second, or at least for velocities of 15 feet and over in the case of large spherical bulbs. This agrees very well with the results obtained by Sworykin, given in the table of section 5, in which the minimum constant required, and consequently the greatest depression or value of  $\tau - \tau_1$ , with small cylindrical bulbs, is very nearly reached with a velocity of ventilation of 3 meters per second, and in the case of large spherical bulbs, the minimum value, of A or greatest value of  $\tau - \tau_1$ , and a value very nearly the same as in the case of the small cylindrical bulbs, is reached with a velocity of about 5 meters per second. Sworykin's minimum value of A for his small cylindrical thermometers also agrees very well with the most probable value 0.000660, which is here obtained (17) from all the experiments with the same kind of thermometers, the whole difference being of no consequence in any practical application of the formula.

16. The following values of A have been obtained from experiments made with a sling psychrometer and a condensing hygrometer: Doyére* from 22 experiments made in 1855, A=0.000678; and Lépensy† from 11 experiments a few years ago, A=0.000693. These experiments were probably made in summer, or at least with medium temperatures, and so should be a little greater than the valve above reduced to freezing. But still they are a little larger than that above, while Sworykin's is about as much smaller

still they are a little larger than that above, while Sworykin's is about as much smaller.

17. From the 7 experiments made by Hazen in Massachusetts with bulb not covered with ice, but in which  $r_1 < 0^\circ$ , we get from (3)

(18) 
$$A = \frac{21.8}{760 \times 45.5} = 0.000627$$

corresponding to an average value of  $r_1 = -1.7^\circ$ . Although this determination has but little weight en account of the fewness of the experiments and the small ranges of  $\tau - r_1$ , yet it does not differ materially from the other values of  $\Delta$ , determined from much larger groups.

There is, however, considerable uncertainty in the indications of the psychrometer when the temperature of the wet bulb is below  $0^\circ$ , and yet is not covered with ice, since if the water should be in the act of freezing and the freezing be not yet perceptible, they would be very erroneous. The latent heat given out in freezing causes the reading of the wet-bulb thermometer to be too high, for this is a source of heat not taken into account in the theory of the formula, nor is the constant of the formula adapted to such a condition. Experiments 162, 163, and 164, not included in the table of section 7, were of this character according to the marginal note of the experimenter. These give a value of A=0.0008, indicating that the temperature of the wet bulb was much too high for ordinary conditions.

18. From the 33 experiments in the table of section 7, in which the wet bulb was covered with ice, we get from (3)

(19) 
$$A = \frac{82.3}{760 \times 161.8} = 0.000670$$

corresponding to a value of  $r=-6^{\circ}.5$ . This is a little larger than the value of (17), although it is well known, according to theory, it ought to be about one-eighth less. The fault is doubtless not in the theory but in the temperature of the wet bulb, which cools slowly when it is covered with ice on account of its small conductivity for heat, so that the bulb does not become cooled down to the minimum with the usual amount of whirling. The average range of  $r-r_1$  in the 33 experiments is only 2°.0, and with this value at the temperature of  $-6^{\circ}.5$ , a diminution of 0°.2 in the wet-bulb temperature would decrease the value of the constant deduced from the experiments the requisite amount to make it agree with the requirements of theory. With the temperatures,

^{*} Paris Ann. Soc. Met., III, 1855, page 60. †Journal de Physique, X, 1881.

therefore, of the ice-covered bulb as usually taken, without long continued ventilation, the same constant can be used in the formula for temperatures of the wet bulb either above or below the freezing point. At any rate an error of one-eighth part in the constant at these low temperatures rarely gives rise to an error in the vapor tension of 0.2 mm., and generally much less

19. The psychrometric formula (1) by means of (10) and (17) becomes

(20) 
$$p=p_1-0.000660 P(r-r_1) (1+0.00115 r_1)$$

Since the part of this expression depending upon  $\tau_1$  is very small, and it is found from experiment, upon the average, that  $r-r_1$  does not differ much from  $r_1$ , we can put without material error for the sake of rendering the expression more convenient for tabulation.

(21) 
$$p=p_1-0.000660 P(r-r_1) \left(1+0.00115 (r-r_1)\right)$$

in which the error will be in each instance,

(22) 
$$E=0.00000076 P(r-r_1) (r-2r_1)$$

This rarely amounts to as much as 0.05mm in the vapor tension.

From what has been stated (20) or (21) can be applied in case the wet bulb is covered with ice, at least when the observation of the wet-bulb temperature is taken with only the usual amount of whirling. And this agrees with the experiments of Sworykin, who found that they were equally well represented by the formula with the same value of A for all temperatures from  $-10^{\circ}$  up to  $+23^{\circ}$ . The number of his experiments and the range of temperature were scarcely sufficient to bring out the small effect in (20) depending upon 71.

The first term in the expression of (21), being a function of  $r_1$  is obtained with  $r=r_1$ , as an argument from Table IV, which is an abridgment of that recently published by the International Bureau of Weights and Measures. The last term of (21), being a function of  $\tau$ — $\tau_1$  and P, is obtained from Table V, with these quantities as arguments. Hence we have

$$(23) P=Table IV-Table V.$$

This very convenient arrangement of tabulation and use of the formula was first devised and recommended by Kaemtz. (Lehrbuch der Meteorologie, Band 1.)

20. From (23), by means of the tables, the values of P in the tables of section 7, under the heading C have been obtained for each of the 791 experiments. The values Punder the heading have been obtained from the table of the International Bureau of Weights and Measures, with the observed dew-point of the condensing hygrometers as an argument. The residuals,  $\theta$ —C, are the differences between the vapor tensions given by the hygrometer and the whirled psychrometer by means of Tables IV and V In the latter the average value of P for each station was used, but the part of the residuals due to this cause is small, since there was, in general, but little fluctuation of barometric pressure.

The value of E (22) was computed for each one of the experiments, and found, on the average, to amount to only 0.016mm, and only in one case did its value amount to as

much as 0.05^{mm}. The errors, therefore, due to this cause are of no importance.

21. Considering the hygrometers (Regnault's mostly) as true standards of comparison, it is seen from the residuals,  $\theta$ -C, that the psychrometer in its application in nearly 800 experiments, made in Colorado, at Washington, and in Massachusetts, and at stations ranging in altitude from sea-level to the top of Pike's Peak, and for a large range of temperature, has given with the same constant in the formula and the same table, very satisfactory results. The probable error, as deduced from the residuals, is only  $0.084^{\rm mm}$ , and the greatest residual only  $0.49^{\rm mm}$ . But the probable error thus deduced is the probable difference simply in any one comparison of the two methods of obtaining the vapor tension, in which the hygrometer must have its share of the error. In the simultaneous experiments of Marvin and Hazen it is found that the principal part of the differences in their results is due to the differences of the observed dew-points, and not to differences in the temperature readings of the psychrometer. The probable error, therefore, of the psychrometer in any one observation of the average weight of the experiments above is only about 0.05 mm. But this implies that the observation should be the average of ten readings of the thermometers, made with the same care as in the experiments. So when there is, as usual, only one reading of each thermometer, the probable error of course will be considerable more.

22. In order to test the applicability of the formula and tables to very high temperatures, a few experiments were made by Professors Marvin and Hazen, conjointly, in Dr. Bové's Turkish baths, Washington, the results of which are contained in the following table.

N		_			p	
No.	7	T1		•	σ	0-C
1 2 8 4	57. 79 59. 29 57. 78 59. 29	82.18 82.40 81.44 82.39	21, 35 22, 92 21, 66 21, 56	mm. 18.87 20.75 19.22 19.11	mm. 22, 44 22, 83 20, 75 22, 32	mm. -3.57 -1.58 -1.53 -3.21

It is seen that the Tables IV and V give vapor tensions too great in each case for that obtained from the observed dew-point. The formula (21) would require a constant equal to 0.000757 to satisfy best these experiments. It would seem, therefore, according to these, that the coefficient of  $r^1$  should be greater even than that in (9), which is also greater than the theoretical value in (10), which has been adopted in constructing the tables. On account of the fewness of the experiments, however, and the inconveniences under which they were made, the results are not decisive, and the whole subject requires further research. In the ten experiments, 392 to 401, inclusive, made in a heated room on Pike's Peak at a much higher temperature, it is seen from the residuals  $\theta$ —C in the tables of section 6, that the experiments are very well satisfied by the tables, but the residuals, though very small, are all negative, as in the preceding table, indicating that a little greater coefficient of  $r_1$  in (20), or of r— $r_1$  in (21) is required. For ordinary ranges of temperature, however, the whole uncertainty is a matter of no consequence in any practical application of the formula and tables.

23. A number of experiments were made to ascertain how long it is necessary to sling the psychrometer with a velocity of 25 feet per second in order to reach the maximum temperature depression  $\tau - \tau_1$  of the wet bulb, and also to ascertain how long it would be necessary to continue to sling it before this would begin to decrease in consequence of the wet bulb's becoming too dry. From the average of nine sets of experiments, in which the wet bulb was first wet with water of the same temperature as the air, and the psychrometer was whirled for ten seconds and then read, then whirled ten seconds longer and read again, and so on, we get the results in the following table in degrees Fahrenheit:

No. of reading.	7	τı	<b>τ−τ</b> 1	No. of reading.	7	T)	7-71
	•	•	•	,	0	•	•
1	55.10	47, 44	7.66	18	55, 08	45, 01	10.07
2	55, 16	45, 78	9, 48	14	55.08	45.07	10.01
2 3	55.18	45.80	9.88	15	55.17	45.21	9.96
4	55. 18	45.18	9.95	16	55.10	45.28	9.82
5	55.17	45, 12	10.05	17	55.09	45.37	9.72
6	55, 20	45.13	10.07	18	55, 20	45.72	9.48
7	55.18	45,06	10, 12	19	55.21	45.97	9, 24
8	55.18	45.08	10.10	20	55, 17	46.67	8.50
9	55, 18	45.09	10.04	21	55.18	47.76	7.52
10	55, 16	45.12	10.04	22	55.23	48,66	6, 57
11	55.18	45, 14	10.04	23	55.20	49, 88	5.87
12	55. 23	45.18	10.05	'			!

The maximum of  $r-r^1$  is reached at about the seventh reading or at the end of a little more than one minute of whirling, or we may say at the end of one minute of continuous whirling, since in the stoppages to read the temperatures there would be meanwhile a slight rise of temperature. With a velocity of whirling, however, of only 10 feet per second the time required to reach the maximum depression would be, perhaps, two or three minutes. Although the maximum depression, as we have seen, section 14, is reached with a velocity of 10 feet per second, especially in the case of small cylindrical bulbs, yet there is an advantage of having a greater velocity, in that it requires less whirling to reach this maximum.

At the end of about 2.5 minutes of whirling at the rate of 25 feet per second, the value of  $r-r_1$  begins to diminish from the effect of the muslin of the wet bulb becoming too dry. Whirling, therefore, at this rate should not be continued beyond this time,

but with smaller velocities of whirling it may, of course, be continued longer, since the smaller the velocity the less the rate with which the muslin dries. This time must depend very much upon the kind of muslin used, coarse or fine, and also upon the kind of bulb. Every observer or experimenter should determine this for the psychrometer in use and not continue to swing or whirl before reading until the bulb becomes too dry. 24. The psychrometric formula (21), expressed in English measures, becomes:

(24) 
$$p=p_1-0.000367 P(\tau-\tau_1) (1+0.00064) (\tau-\tau_1)$$

This, reduced to tables in the manner in which (21) has been, gives Tables I and II instead of Tables IV and V in international measures. Hence we now have, instead of (23),

$$(25) p = Table I - Table II.$$

Using now Table I in an inverse manner, the value of  $\tau$  corresponding to this value of

p found in the interior of the table, is dew-point  $\delta$ .

With the air temperature \( \tau \) and the dew-point \( \delta \), we get the depression of the dewpoint  $(\tau-\delta)$ . Then with  $\tau$  and  $(\tau-\delta)$  as arguments, Table III gives the relative humidity, R.

Table II, with  $r=r_1=84.3 \cdot r_1=66^{\circ}.7$ , and P=25.3 inches to find  $p \circ and R$ .

Table II, with  $r=r_1=66^{\circ}.70$  as an argument, gives  $p_1=0.654$  inch.

Table II, with  $r=r_1=84^{\circ}.3-66^{\circ}.7=17^{\circ}.6$  and p=25.5 inches (the nearest argument in the table to 25.3 inches) as arguments, gives 0.167 inch as the value of the last term in (24). Hence by (25) we get

$$p = 0.654 - 0.167 = 0.487$$
 inch.

The value of  $\tau$ , Table I, corresponding with 0.487 inch in the table, is the dewpoint  $l=58^{\circ}.3$ .

Table III, with  $\tau = 84^{\circ}.3$  and  $\tau = \delta = 84^{\circ}.3 - 58^{\circ}.3 = 26^{\circ}.0$  as arguments, then gives 42°.

			1	i						
7	o _o	10	20	8°	40	50	6°	7°	80	
-30 -20	In. 0.010 0.017	In. 0.009 0.016	In. 0.009 0.015	In. 0,008 0.014	In. 0.008 0.014	In. 0.007 0.013	In. 0.007 0.012	In. 0.007 0.011	In. 0.006 0.011	In. 0.006 0.010
-10	0. 028	0.026	0.025	0.024	0, 023	0.022	0.020	0.019	0.018	0.018
- 0	0. 045	0.043	0.041	0.039	0, 037	0.035	0.034	0.032	0.031	0.029
+ 0	0. 045	0.047	0.049	0.052	0, 054	0.057	0.059	0.062	0.065	0.068
10	0. 071	0.074	0.078	0.061	0, 085	0.088	0.092	0.096	0.101	0.105
20	0. 110	0.114	0.119	0.124	0, 130	0.135	0.141	0.147	0.153	0.159
•	<b>0°.</b> 0	0°.1	0°.2	0°.3	0°.4	0°.5	0°.6	0°.7	0°.8	0°.9
30	0. 166	0.167	0.167	0.168	0. 169	0. 169	0.170	0. 171	0, 171	0. 172
31	0. 173	0.178	0.174	0.175	0. 176	0. 176	0.177	0. 178	0, 178	0. 179
32	0. 180	0.181	0.181	0.182	0. 183	0. 184	0.184	0. 185	0, 186	0. 186
33	0. 187	0.188	0.189	0.189	0. 190	0. 191	0.192	0. 192	0, 193	0. 194
34	0. 195	0.196	0.196	0.197	0. 198	0. 199	0.200	0. 200	0, 201	0. 202
35	0. 208	0, 204	0. 204	0. 205	0. 206	0. 207	0. 208	0, 208	0, 209	0. 210
36	0. 211	0, 212	0. 213	0. 213	0. 214	0. 215	0. 216	0, 217	0, 218	0. 218
37	0. 219	0, 220	0. 221	0. 222	0. 223	0. 224	0. 225	0, 225	0, 226	0. 227
38	0. 228	0, 229	0. 230	0. 231	0. 232	0. 233	0. 233	0, 234	0, 235	0, 236
39	0. 237	0, 238	0. 239	0. 240	0. 241	0. 242	0. 243	0, 244	0, 245	0. 246
40	0, 246	0, 247	0, 248	0. 249	0, 250	0, 251	0. 252	0, 253	0, 254	0, 255
41	0, 256	0, 257	0, 258	0. 259	0, 260	0, 261	0. 262	0, 263	0, 264	0, 265
42	0, 266	0, 267	0, 268	0. 269	0, 270	0, 271	0. 272	0, 273	0, 274	0, 276
43	0, 277	0, 278	0, 279	0. 280	0, 281	0, 282	0. 283	0, 284	0, 285	0, 286
44	0, 287	0, 298	0, 290	0. 291	0, 292	0, 293	0. 294	0, 295	0, 296	0, 297
45	0, 298	0, 800	0.301	0, 302	0. 303	0, 304	0.305	0, 306	0, 308	0, 309
46	0, 810	0, 811	0.812	0, 813	0. 315	0, 316	0.317	0, 318	0, 319	0, 821
47	0, 822	0, 828	0.824	0, 825	0. 327	0, 328	0.329	0, 330	0, 332	0, 833
48	0, 834	0, 835	0.837	0, 838	0. 339	0, 340	0.342	0, 343	0, 344	0, 345
49	0, 817	0, 848	0.349	0, 851	0. 352	0, 353	0.356	0, 356	0, 357	0, 359
50	0.860	0. 361	0, 363	0, 364	0, 365	0. 367	0, 368	0.869	0.871	0, 872
51	0.878	0. 875	0, 376	0, 378	0, 379	0. 380	0, 882	0.883	0.885	0, 886
52	0.887	- 0. 889	0, 890	0, 392 -	0, 393	0. 395	0, 396	0.897	0.899	0, 400
53	0.402	0. 403	0, 405	0, 406	0, 408	0. 409	0, 411	0.412	0.414	0, 415
54	0.417	0. 418	0, 120	0, 421	0, 423	0. 424	0, 426	0.427	0.429	0, 421

TABLE I .- Tension of aqueous vapor.

TABLE I.—Tension of aqueous vapor—Continued.

-	0°.0	0°.1	0°.3	0°.8	0°.4	0°.5	0°.6	0°.7	0°.8	0°.9
o +55 56 57 58 59	In. 0.433 0.448 0.464 0.481 0.499	In. 0.434 0.450 0.466 0.483 0.501	In. 0.435 0.451 0.468 0.485 0.503	In. 0,437 0,453 0,470 0,487 0,504	In. 0.438 0.455 0.471 0.498 0.506	In. 0.440 0.456 0.473 0.490 0.508	In. 5.442 0.458 0.475 0.492 0.510	In. 0.443 0.460 0.476 0.494 0.512	In. 0. 445 0. 461 0. 478 0. 495 0. 513	In. 0.446- 0.463 0.480 0.497 0.515
60	0.517	0.519	0, 521	0, 523	0, 524	0, 526	0. 528	0.530	0.532	0, 534
61	0.536	0.538	0, 589	0, 541	0, 543	0, 545	0. 547	0.549	0.551	0, 553
62	0.555	0.557	0, 559	0, 561	0, 563	0, 565	0. 567	0.569	0.571	0, 578
63	0.575	0.577	0, 579	0, 581	0, 583	0, 565	0. 587	0.589	0.591	0, 593
64	0.595	0.577	0, 599	0, 601	0, 604	0, 606	0. 608	0.610	0.612	0, 614
65	0.616	0, 618	0.621	0. 623	0, 625	0, 627	0. <b>629</b>	0. 631	0. 634	0.636
66	0.688	0, 640	0.642	0. 645	0, 647	0, 649	0. <b>651</b>	0. 654	0. 656	0.658
67	0.660	0, 663	0.665	0. 667	0, 670	0, 671	0. <b>674</b>	0. 677	0. 679	0.681
68	0.684	0, 686	0.688	0. 691	0, 693	0, 695	0. <b>608</b>	0. 700	0. 703	0.705
69	0.707	0, 710	0.712	0. 715	0, 717	0, 720	0. <b>722</b>	0. 724	0. 727	0.730
70	0.782	0.734	0.737	0.740	0.742	0, 745	0.747	0.750	0.752	0, 754
71	0.757	0.760	0.762	0.765	0.768	0, 770	0.773	0.775	0.778	0, 781
72	0.783	0.786	0.789	0.791	0.794	0, 797	0.799	0.802	0.805	0, 807
78	0.810	0.813	0.816	0.818	0.821	0, 824	0.827	0.829	0.832	0, 835
74	0.838	0.841	0.844	0.846	0.849	0, 852	0.855	0.858	0.861	0, 864
75	0, 866	0.889	0.872	0, 875	0.878	0, 881	0, 884	0.887	0.890	0.893
76	0, 896	0.899	0.902	0, 905	0.908	0, 911	0, 914	0.917	0.920	0.923
77	0, 926	0.929	0.982	0, 935	0.938	0, 941	0, 944	0.948	0.951	0.954
78	0, 957	0.960	0.963	0, 967	0.970	0, 973	0, 976	0.979	0.983	0.986
79	0, 989	0.992	0.996	0, 999	1.002	1, 103	1, 009	1.012	1.015	1.019
80	1.022	1,025	1,029	1,032	1.035	1.039	1.042	1.046	1,049	1.052
81	1.056	1,059	1,068	1,066	1.070	1.073	1.077	1.080	1,084	1.087
82	1.091	1,094	1,098	1,101	1.105	1.109	1.112	1.116	1,119	1.123
86	1.127	1,180	1,184	1,138	1.141	1.145	1.149	1.152	1,156	1.160
84	1.163	1,167	1,171	1,175	1.179	1.182	1.186	1.190	1,194	1.198
85	1.202	1. 205	1. 209	1.218	1, 217	1. 221	1, 225	1. 229	1. 233	1.237
86	1.241	1. 245	1. 249	1.253	1, 256	1. 260	1, 265	1. 269	1. 273	1.277
87	1.281	1. 285	1. 289	1.293	1, 297	1. 301	1, 305	1. 310	1. 314	1.318
88	1.822	1. 826	1. 830	1.835	1, 839	1. 343	1, 347	1. 852	1. 356	1.360
89	1.864	1. 869	1. 873	1.877	1, 882	1. 386	1, 391	1. 395	1. 899	1.404
90	1.408	1.418	1.417	1, 421	1. 426	1. 430	1.435	1.439	1.444	1.449
91	1.453	1.458	1.462	1, 467	1, 471	1. 476	1.481	1.485	1.490	1.494
92	1.499	1.504	1.508	1, 513	1. 518	1. 523	1.527	1.582	1.537	1.542
93	1.546	1.551	1.556	1, 561	1. 566	1. 571	1.575	1.580	1.565	1.590
94	1.595	1.600	1.605	1, 610	1, 615	1. 620	1.625	1.630	1.633	1.640
95	1.645	1.650	1.655	1.660	1.665	1. 671	1.676	1.681	1.686	1.691
96	1.696	1.702	1.707	1.712	1.717	1. 723	1.728	1.783	1.789	1.744
97	1.749	1.755	1.760	1.765	1.770	1. 776	1.782	1.787	1.792	1.798
98	1.803	1.809	1.814	1.820	1.825	1. 831	1.837	1.842	1.848	1.853
99	1.859	1.865	1.870	1.876	1.882	1. 887	1.893	1.899	1.905	1.910
100	1. 916	1, 922	1, 928	1, 934	1, 939	1, 945	1. 951	1.957	1.963	1, 969
101	1. 975	1, 981	1, 987	1, 993	1, 999	2, 005	2. 011	2.017	2.023	2, 029
102	2. 035	2, 041	2, 047	2, 053	2, 059	2, 066	2. 072	2.078	2.084	2, 090
103	2. 097	2, 103	2, 109	2, 116	2, 122	2, 128	2. 135	2.141	2.147	2, 154
104	2. 160	2, 166	2, 173	2, 179	2, 186	2, 192	2. 199	2.205	2.212	2, 219
105	2, 225	2, 282	2, 238	2, 245	2. 252	2, 258	2. 265	2, 272	2,278	2, 285
106	2, 292	2,299	2, 305	2, 312	2. 319	2, 326	2. 383	2, 340	2,347	2, 853
107	2, 360	2, 367	2, 874	2, 881	2. 388	2, 395	2. 402	2, 409	2,416	2, 423
108	2, 431	2, 488	2, 445	2, 452	2. 459	2, 466	2. 474	2, 481	2,488	2, 495
109	2, 503	2, 510	2, 517	2, 525	2. 532	2, 539	2. 547	2,554	2,562	2, 569
110	2.576	2, 584	2, 591	2, 599	2. 607	2.614	2. 622-	2, 629	2,687	2, 645
111	2.652	2, 660	2, 668	2, 675	2. 683	2.691	2. 699	2, 706	2,714	2, 722
112	2.730	2, 738	2, 746	2, 754	2. 762	2.769	2. 777	2, 785	2,793	2, 801
118	2.810	2, 818	2, 826	2, 884	2. 842	2.850	2. 858	2, 866	2,875	2, 883
114	2.891	2, 899	2, 908	2, 916	2. 924	2.933	2. 941	2, 950	2,958	2, 966
115	2, 975	2. 988	2, 992	8,000	3, 009	3, 017	8. 026	3. 035	8. 043	3, C53
116	8, 061	8. 069	8, 078	8,087	3, 096	3, 104	3, 118	8. 122	8. 131	3, 146
117	8, 149	8. 157	8, 166	8,175	8, 184	3, 198	3. 202	8. 211	8. 220	8, 229
118	8, 239	8. 248	8, 257	8,266	3, 275	3, 284	8. 294	3. 303	3. 312	3, 321
119	8, 831	8. 840	8, 850	8,859	3, 368	3, 378	8. 387	3. 397	8. 406	3, 416

TABLE II.—Values of 0.000367  $P(\tau-\tau_1)$   $\left(1+\frac{\tau-\tau_1}{1571}\right)$ .

[Arguments:  $\tau - \tau_i$  and P.]

					Baron	etric p	ressure	P in in	ches.				
-n	30.5	30.0	29.5	29.0	28.5	28.0	27.5	27.0	26.5	26.0	25, 5	25.0	24.
۰	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.	In
1	.011	.011	.011	.011	. 010	.010	.010	.010	. 010	.010	.009	.009	0.0
2 3	.022	.022	. 022	.021	.021	. 021	.020	.020	. 019	.019	.019	.018	1.6
4	.034	.033	.033	.032	.031	.081 .041	.030	.03J .040	.029	.029	.028	.027	1 :3
5	.056	.055	.054	.053	.052	.052	.051	.050	.049	.048	.047	.046	:
6	.067	.066	. 065	.064	. 063	. 062	.061	.060	.059	.057	.056	. 055	. [
7 8	.079	.077	.076	.075	.073	.072	.071	.070	.068	.067	.066	.064	
9	.090	.099	.087	.086	.084	.083	.081	.090	.078	.077	.075	.074	
10	.113	.111	.109	.096 .107	.105	. 103	.102	.100	.098	.096	.094	.092	:
11 12 18	. 124	. 122	. 120	. 118	.116	.114	.112	.110	. 108	.106	.104	. 102	١.;
12	.185	.133	. 181	.129	.126	. 124	. 122	.120	.118	. 115	.118	.111	
14	.158	. 144	.153	.150	.137 .148	.145	.143	. 130	.127	. 125 . 185	.123	.120	
15	.170	. 167	.164	.161	.158	.156	. 153	.150	.147	.144	.142	. 139	::
16 17	.181	.178	.175	.172	.169	. 166	. 163	. 160	. 157	. 154	. 151	. 148	
17	.192	.189	.186	. 183	.180	.177 .187	.173	.170 .180	. 167 . 177	. 164 . 174	. 161 . 170	. 158	
19	. 204 . 215	.212	.208	.205	.201	.198	.194	. 191	.187	.183	.180	. 176	
20	.227	.223	.219	.216	212	. 208	. 204	. 201	. 197	.198	.190	. 186	
21 22 23 24	. 238 . 250	. 234 . 246	. 230	. 226 . 237	. 228	. 219 . 229	. 215 . 225	. 211 . 221	. 207	. 203	.199	. 195	۱.,
22	.261	.246	.242	.237	. 244	. 240	.236	.221	.217 .227	. 213	. 209 . 218	. 205	:
24	.278	.268	. 264	259	. 255	250	.246	.241	.237	. 233	.228	224	: 2
25	. 284	. 280	. 275	.270	. 266	. 261	. 256	. 252	.247	. 242	. 238	. 283	
26 27 28 29 30	. 296 . 307	. 291	. 286 . 297	. 281	. 277 . 287	. 272 . 282 . 293	. 267 . 277	. 262 . 272	. 257 . 267	. 252 . 262	. 247 . 257	. 243 . 252	.2
24	.819	.814	.309	. 303	.298	293	. 288	. 282	.207	.272	.267	. 261	.2
29	.831	.825	. 820	.814	. 309	304	298	. 293	. 287	. 282	. 276	271	. 2
80	.342	.837	.831	.825	. 320	. 314	. 309	. 303	. 297	. 292	. 286	. 281	. 2
31 32 33	. 354	. 348 . 859	. 342 . 354	.336	.331	. 325 . 336	.319	. 313	.307	. 302	. 296	.290	.2
22	.877	.839	. 365	. 359	.352	. 846	.340	. 834	.328	. 322	.315	.809	.8
34 35	. 389	. 382	. 376	.870	. 363	. 857	. 851	. 344	. 338	. 331	. 325	. 819	.8
85	. 401	.894	.387	. 381	.874	. 368	. 361	. 355	. 348	.841	. 835	.328	.8
36	.412	.405	. 399	. 392	. 385	. 378	.372 .382	. 365 . 375	. 358	.351 .361	. 345 . 854	.338	.8
20	.436	.428	.421	.414	407	.400	.393	.386	. 379	.871	.864	.357	. 8
37 33 39	447	.440	. 433	. 425	.418	.411	.403	. 896	. 389	. 381	. 864 . 874	. 367	.8
40	459	452	.444	. 437	.429	. 422	.414	.406	. 399	. 391	. 384	. 876	.8

TABLE II.—Continued.

	1												
				В	romet	ric pres	sure P	in inch	es.				
7-71	24.0	23.5	23.0	22.5	22.0	21.5	21.0	20.5	20.0	19.5	19.0	18.5	18.0
•	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.
1	.009	.009	.008	.008	.008	.008	.008	.008	.007	.007	.007	.007	.007
3 8	.026	.026	.017	.025	.024	.024	.023	.023	.022	.021	.021	.020	.020
4	.035	.035	.034	.033	.032	. 032	.031	.030	.029	. 029	.028	.027	.026
5	.044	.043	.042	.041	.040	.040	.039	.038	.037	.026	.035	.034	.033
6	.053	.052	.051	.050	.049	.048	.046	. 045	.044	.048	.042	.041	.040
7 8	.062	.061	.059	.058	.057	.055	.054	.053	.052	.050	.049	.048	.046
9	.080	.078	.076	.075	:073	.071	.070	.068	.066	.064	.063	.061	.060
10	.089	.087	.065	.083	.081	.079	.078	.076	.074	.072	.070	.068	.066
11 12 13 14	.098	.096	.094	.091	.089	.087	.085	.083	.081	.079	.077	.075	.073
12	.107	.104	.102	.100 .108	.098	.095	.093	.091	.089	.086	.064	.082	.080
14	124	.122	1119	:117	114	.111	109	.099	.104	.098	.098	.089	.098
15	.183	. 181	.128	.125	.122	.119	.117	.114	iii	.108	.105	.102	.100
16	.143	.139	.136	.183	. 130	.128	.125	.122	.119	.116	.113	.110	.104
16 17 18	. 151	.148	.145	.142	. 139	.136	.132	.129	.126	. 123	.120	.117	.117
18 19	.160	.157	.154	.150 .159	.149 .155	.144	.140	.137 .145	.134	.130 .137	.127	.124	.123 .120
20	.178	.175	:171	.167	.164	.160	.156	152	.149	144	.141	.137	.137
21	.187	.184	.180	.176	.172	.168	.164	. 160	.156	.152	.148	.144	.141
22	.196	.192	.188	.184	.180	.176	.172	.168	.164	.160	. 156	. 151	.147
23	.206	.201	.197	.193 .201	.188	.184 .192	.180	.176	.171	.167	.163	.158 .165	.154
21 22 23 24 25	.215 .224	.219	.214	.210	.205	200	.196	.191	.186	.182	.170 .177	.172	.168
26	.233	.228	.223	.218	. 213	.209	. 204	.199	.194	.189	.184	.179	.175
26 27 28	. 242	.237	. 232	.227	. 222	.217	.212	.207	. 202	. 197	.192	.186	. 181
28	.251	. 246	.241	. 235	.230	.235	.220	. 214	. 209	. 204 . 211	.199	.198	.183
29 30	.269	.264	.258	.252	.247	.233	.228	.230	.217	.219	. 206 . 213	.201 .208	.195
81	.278	. 278	. 267	.261	. 255	. 249	. 244	. 238	. 232	. 226	. 220	. 215	.209
82	.288	. 282	276	.270	.264	. 258	.252	. 246	.240	. 234	.228	.213	.216
82 83 84	.288 .297	. 291	.284	.270 .278	. 272	. 266	.260	. 253	.247	.241	. 235	.229	.223
84 85	.306 .315	.800	.293	. 287 . 295	.280	. 274	. 268 . 276	. 261	. 255	. 249 . 256	. 242	.236	.229
												. •	
36 37 38 39	.824 .334	.318	.311 .320	.304 .313	. 297	.291	. 284	. 277	. 270	. 264	. 257	.250	.243 .250
88	.848	.836	.829	.821	.814	.307	.300	. 285 . 293	.278	.279	.204	. 257 . 264	.257
89	. 352	. 845	.837	.830	. 328	. 815	.808	. 801	. 286 . 293	. 286	. 279	.271	.264
40	.361	.854	.846	. 889	.881	. 824	.816	. 309	. 301	. 294	. 286	.278	.271
									1	1			ı

## REPORT OF THE CHIEF SIGNAL OFFICER.

## TABLE III. - Relative humidity.

## [Expressed in hundredths.]

Air mp.		Depression of dew-point (τ-δ)														
7	0	1	2	8	4	5	6	7	8	9	10	11	12	18	14	1
- 85 - 82 - 28 - 24 - 20	100 100 100 100 100	94 94 95 95	87 88 89 90	82 83 84 85 85	77 79 80 80 80	74 75 76 76	69 71 72 72	65 67 68 68	61 68 64 64	59 60 61	55 57 57	52 53 53	48 50 51	47 48	44 46	4
- 16 - 12 - 8 - 4 0	100 100 100 100 100	95 95 95 95 96	90 90 91 91 91	86 86 86 87 87	81 82 82 83 83	77 78 78 79 79	78 74 74 75 75	69 70 71 71 72	65 66 67 68 69	62 63 64 65 65	58 60 61 62 62	55 57 58 58 59	52 54 55 56 56	49 50 52 53 54	47 48 49 50 51	
8 12 16 20	100 100 100 100 100	96 96 96 96 96	92 92 92 92 92	88 88 88 88	84 84 84 84 84	80 80 80 80 81	76 76 76 76 77	72 78 78 78 74	69 70 70 70 71	66 66 67 67 68	63 68 64 64 65	60 61 61 61 62	57 58 58 59 59	55 55 55 56 56	52 53 53 54 54	
24 28 22 25 26 40	100 100 100 100 100	96 96 96 96 96	92 92 92 93 93	88 89 89 89	84 85 86 85 85	81 81 82 82 82	77 78 79 79 79	74 75 76 76 76	71 72 72 78 78	68 68 69 69 70	65 65 66 66 67	52 62 63 64 64	60 60 61 62 62	57 57 58 59 59	55 55 56 57 57	
44 48 52 56 60	100 109 109 100 100	96 96 96 96 96	98 93 93 93	89 89 89 90	86 86 86 86 87	83 83 83 84	79 80 80 80 81	76 77 77 77 78	78 74 74 75 76	71 71 71 72 72	68 68 69 69 70	65 66 66 67 67	63 63 94 64 65	60 61 61 62 62	58 58 59 60 60	
64 68 72 76 80	100 100 100 100 100	97 97 97 97 97	98 98 94 94	90 90 90 90	87 87 87 87 88	84 84 85 85	81 81 82 82 82	78 78 79 79 79	75 76 76 76 76 77	78 78 78 74 74	70 71 71 71 71 72	68 68 69 69	65 66 67 67	63 64 64 65	61 61 62 62	
84 85 92 96 100	100 100 100 100 100	97 97 97 97 97	94	91 91 91 91 91	88 88 88 88 88	85 85 85 86 86	82 83 83 83 83	80 80 80 80 81	77 77 78 78 78 78	74 75 75 75 76	72 72 78 78 78	70 70 70 71 71	67 68 68 69	65 66 66 66 67	63 64 64 65	
104 108 112 116 120	100 100 100 100 100	97 97 97 97 97	88888	91 92 92 92 92	89 89 89 89	86 86 86 87 87	88 84 84 85	81 81 82 83 83	78 79 79 79 80	76 76 77 77	74 74 74 75 75	71 72 72 78 78	69 70 70 71 71	67 68 68 68	65 66 66 67	

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TABLE III.—Relative humidity.—Continued.

Air temp.					Depres	sion o	of the	dew-p	oint (1	r — 8).						_
τ.	15	18	17	18	19	20	21	22	23	24	25	26	27	28	29	80
- 24 - 20	41 43	88 40	88	86	84	82	1									
- 16 - 12 - 8 - 4 0	44 45 47 48 49	41 42 44 45 46	40 40 41 43 44	87 38 89 41 42	85 86 87 88 89	88 84 85 86 87	81 82 83 84 86	29 80 31 82 84	27 28 29 31 32	25 27 28 29 30	25 26 27 29	24 25 26 27	22 23 24 25	21 23 28 24	20 21 23	19 20 21
+ 4 8 12 16 20	50 50 51 51 52	47 48 48 49 49	45 45 46 46 47	43 48 44 44 45	40 41 42 42 43	88 89 40 40 41	36 87 88 89 89	85 86 87 87	83 84 84 85 86	81 82 82 83 84	80 80 81 81 81	28 29 29 30 81	27 28 28 29 80	25 26 26 27 28	24 25 25 26 26	2222
+ 24 28 82 36 40	52 58 54 54 55	50 51 51 52 53	47 48 49 50 50	45 46 47 48 48	43 44 45 46 47	42 42 48 44 45	40 40 41 42 43	88 88 89 40 41	36 87 87 88 89	35 35 36 37 38	88 83 84 85 85	82 82 83 84 85	80 81 81 82 83	29 29 80 81 82	27 28 28 29 29	25 26 27 28 29
+ 44 48 52 56 60	55 56 57 57 58	53 54 54 55 56	51 52 52 53 54	49 50 50 51 52	47 48 48 49 50	45 46 46 47 48	48 44 44 45 46	42 42 43 44 44	40 40 41 42 43	88 89 40 40 41	36 37 39 39	35 36 37 37 38	83 84 85 85	82 83 84 84 85	30 81 82 83 83	29 30 31 32 32
+ 64 68 72 76 80	58 59 59 60	56 57 57 58 58	54 55 55 56 56	52 53 53 54 54	50 51 52 52 52 52	48 49 49 50 51	47 47 48 48 48	45 45 46 47 47	48 44 44 45 45	42 43 43 44	40 40 41 42 42	89 89 40 40 41	87 87 88 39 39	86 86 87 87 88	34 34 35 36 36	83 83 84 85 85
+ 84 86 92 96 100	61 61 62 62 63	59 59 60 60 61	57 57 58 58 58	55 55 56 56 57	53 53 54 55 55	51 52 52 53 53	49 50 50 51 52	48 48 49 49 50	46 47 47 48 48	44 45 46 46 47	48 48 44 45 45	42 42 43 44 44	40 40 41 42 42	89 89 40 40 41	37 87 38 39 39	36 36 37 38
104 108 112 116 120	68 64 64 64 65	61 62 63 68	59 60 60 61 61	57 58 58 60 59	56 56 57 57 58	54 54 55 55 56	53 53 54 54 54	51 51 52 52 52	49 49 50 50 51	47 48 48 49 50	46 46 47 49 48	45 45 46 47 47	48 48 44 45 45	41 42 43 43 44	40 41 42 42	89 40 41 41

TABLE III.—Relative humidity—Continued.

Air		Depression of dew-point (τ — Δ).  30 33 36 39 42 45 48 51 54 57 60 63 66 69 72 75														
temp.	30	33	36	89	42	45	48	51	54	57	60	63	66	69	72	75
- 8 - 4 0	19 20 21	17 18	14 15	13												
+ 4 8 12 16 20	22 23 23 21 25	19 19 20 21 22	16 16 17 18 19	14 14 15 16 16	12 12 13 13 14	10 10 11 11 12	8 9 9	7 8 8	7 7	6	5					
+ 24 28 32 36 40	25 26 27 28 29	22 23 24 24 21 25	19 20 21 21 22	16 17 18 18 18	14 15 16 16 17	12 18 14 14 14	10 11 12 12 13	9 9 10 10 11	7 8 8 9	6 7 7 7	5 6 6 6	4 5 5 5 5	4 4 4	8 4 4	8 3 8	8
+ 44 48 52 56 60	29 30 31 82 82	26 26 27 28 23	23 23 24 24 25	20 20 21 21 22	17 18 18 19	15 16 16 17 17	13 14 14 15 15	11 12 12 13 18	9 10 10 11 11	8 9 9	7 8 8 9	6 6 7 7 8	5 6 6 7	5 5 5 5 6	4 4 4 5	8 4 4
+ 64 68 72 76 80	83 84 85 85	29 29 30 31 81	26 26 27 28 28	28 23 24 25 25	20 20 21 22 23	18 18 19 19 20	16 16 17 17 18	14 14 15 15 16	12 12 18 18	10 11 11 11 11	9 10 10 10 11	8 8 9 9	7 7 7 8 8	6 6 7 7	5 5 6 6	5 5 6 6
+ 84 88 92 96 100	36 36 37 38 38	82 83 84 84	29 29 30 30 81	26 26 27 27 28	23 24 24 24 25	20 21 21 22 22 22	18 19 19 20 20	16 17 17 18 18	14 15 15 16 16	12 18 18 14 14	11 12 12 13 18	9 10 10 11 11	8 8 9	7 8 8 8 8	6 7 8 8	6 7 7 7
+104 198 112 116 120	89 40 41 41	85 85 86 87 87	82 83 83 84	29 29 80 80 81	26 26 27 27 28	23 23 24 24 25	21 21 22 22 23 23	19 19 20 20 21	17 17 18 18 19	15 15 16 16 17	18 14 14 15 15	11 12 12 13 13	10 11 11 11 12	9 10 10 10	8 9 9 9 10	7 8 8 8

TABLE IV .- Tension of aqueous vapor in millimeters.

•	00	10	20	80	40	50	60	70	80	90
-80	0.88	0. 35	0, 82	0. 29	0, 26	0. 28	0. 21	0. 19	0.17	0.15
-90	0.94	0. 87	0, 79	0. 78	0, 66	0. 61	0. 55	0. 50	0.46	0.42
-10	2.18	1. 99	1, 84	1. 69	1, 56	1. 44	1. 82	1. 22	1.12	1.03
-0	4.57	4. 25	8, 95	8. 67	8, 41	8. 16	2. 98	2. 72	2.51	2.33
	0°.0	0°.1	0°.2	0°.8	0°.4	0°.5	0°.6	0°.7	0°.8	0°.9
0	4. 57	4.60	4. 68	4. 67	4.70	4.74	4.77	4.80	4.84	4. 87
1	4. 91	4.94	4. 98	5. 02	5.05	5.09	5.12	5.16	5,20	5. 23
2	5. 27	5.81	5. 85	5. 39	5.42	5.46	5.50	5.54	5.58	5. 62
8	5. 66	5.70	5. 74	5. 78	5.82	5.86	5.90	5.94	5.98	6. 08
4	6. 07	6.11	6, 15	6. 20	6.24	6.28	6.83	6.87	6,42	6. 46
5	6.51	6.55	6.60	6. 64	6.69	6.74	6.78	6. 88	6. 88	6. 92
6	6.97	7.02	7.07	7. 12	7.17	7.21	7.26	7. 81	7. 36	7. 42
7	7.47	7.52	7.57	7. 62	7.67	7.72	7.78	7. 88	7. 88	7. 94
8	7.99	8.05	8.10	8. 15	8.21	8.27	8.82	8. 88	8. 43	8. 40
9	8.55	8.61	8.66	8. 72	8.78	8.84	8.90	8. 96	9. 02	9. 06
10	9. 14	9. 20	9.26	9, 82	9. 89	9. 45	9.51	9.57	9.64	9, 70
11	9. 77	9. 88	9.90	9, 96	10. 08	10.09	10.16	10.23	10.80	10, 36
12	10. 48	10. 50	10.57	10, 64	10. 71	10.78	10.85	10.92	10.99	11, 66
18	11. 14	11. 21	11.28	11, 86	11. 48	11.50	11.58	11.65	11.78	11, 81
14	11. 88	12. 96	12.04	12, 12	12. 19	12.27	12.85	12.43	12.51	12, 59
15	12.67	12, 76	12.84	12, 92	18,00	13.09	18, 17	18, 25	18,84	13.42
16	13.51	13, 60	• 18.68	13, 77	18,86	13.95	14, 04	14, 12	14,21	14.30
17	14.89	14, 49	14.56	14, 67	14,76	14.86	14, 95	15, 04	15,14	15.23
18	15.38	15, 48	15.52	15, 62	15,72	15.82	15, 92	16, 02	16,12	16.23
19	16.82	16, 42	16.52	16, 68	16,78	16.83	16, 94	17, 04	17,15	17.25
20	17. 36	17. 47	17.58	17. 69	17.80	17. 91	18.02	18, 13	18, 24	18.35
21	18. 47	18. 58	18.69	18. 81	18.92	19. 04	19.16	19, 27	19, 89	19.51
22	19. 68	19. 75	19.87	19. 99	20.11	20. 24	20.36	20, 48	20, 61	20.78
28	20. 86	20. 98	21.11	21. 24	21.87	21. 50	21.63	21, 76	21, 89	21.02
24	22. 15	22, 29	22.42	22. 55	22.69	22. 83	22.96	23, 10	23, 24	23.88
25	28. 52	28, 66	23. 80	28, 94	24.08	24. 23	24.87	24.52	24, 66	24. 81
26	24. 96	25, 19	25. 25	25, 40	25.55	25. 70	25.86	26.01	26, 16	26. 32
27	26. 47	26, 63	26. 78	26, 94	27.10	27. 26	27.42	27.58	27, 74	27. 90
28	28. 07	28, 23	28. 39	28, 56	28.78	28. 89	29.06	29.23	29, 40	29. 57
29	29. 74	29, 92	30. 09	80, 26	30.44	80. 62	80.79	30.97	81, 15	81. 83
80	31.51	81. 69	81.87	82, 06	82, 24	82, 48	82. 61	82.80	82, 99	33, 18
81	83.87	83. 56	83.75	83, 94	84, 44	84, 88	84. 53	84.72	84, 92	35, 12
82	85.32	85. 52	85.72	85, 92	86, 18	86, 83	86. 54	86.74	86, 95	37, 16
83	87.87	37. 58	87.79	88, 00	88, 22	88, 43	88. 65	88.87	89, 06	39, 30
84	39.52	89. 74	89.97	40, 19	40, 41	40, 64	40. 87	41.09	41, 82	-41, 55
85	41. 78	42, 02	42, 25	42, 48	42.72	42.96	43, 19	43, 43	43,67	48. 92
86	44. 16	44, 40	44, 65	44, 89	45.14	45.89	45, 64	45. 89	46,14	46. 39
87	46. 65	46, 90	47, 16	47, 42	47.68	47.94	48, 20	48. 46	48,78	48. 99
88	49. 26	49, 53	49, 80	50, 07	50.84	50.61	50, 89	51. 16	51,44	51. 72
89	52, 00	52, 28	52, 56	52, 84	58.13	53.41	53, 70	53. 99	54,28	54. 57
40	54.87	55, 16	55 45	55. 75	56, 05	56, 35	56, 65	56. 95	57. 26	57.56
41	57.87	58, 18	58. 49	58. 80	59, 11	59, 43	59, 74	60. 06	60. 38	60.70
42	61.02	61, 84	61. 66	61. 99	62, 82	62, 64	62, 98	63. 81	63. 64	63.97
43	64.81	64, 65	64. 99	65. 83	65, 67	66, 01	66, 36	66, 71	67. 05	67.40
44	67.76	68, 11	68. 46	68. 82	69, 18	69, 54	69, 90	70, 26	70. 63	70.99

# TABLE V.—Values of 0.000680 P $(r-r_1)$ $\left(1+\frac{r-r_1}{873}\right)$

[Arguments: (r-n) and P.]

					Bai	ometr	ic pres	sure,	P, in p	aillim	eters.					
	770	760	750	740	780	720	710	700	690	660	670	660	650	640	630	630
1 2 3 4 5	0.52 1.03 1.54 2.04 2.56	0.51 1.01 1.52 2.02 2.52	0.50 1.00 1.49 1.99 2.49	0.50 0.98 1.47 1.97 2.46	0.49 0.97 1.45 1.94 2.43	0, 48 0, 96 1, 43 1, 91 2, 89	0. 48 0. 94 1. 41 1. 89 2. 36	0. 47 0. 93 1. 89 1. 86 2. 82	0.46 0.92 1.87 1.83 2.29	0.46 0.90 1.85 1.81 2.26	0.45 0.89 1.83 1.78 2.23	0.44 0.88 1.82 1.75 2.19	0.44 0.87 1.80 1.78 2.17	0.85 1.28 1.70	1.67	
6 7 8 9	8.07 8.59 4.11 4.63 5.15	8.08 8.54 4.05 4.56 5.08	2.99 8.50 4.00 4.50 5.01	2.95 8.45 8.95 4.44 4.94	2.91 8.40 3.89 4.88 4.88	2.87 8.36 8.84 4.82 4.81	2.88 8.81 8.79 4.27 4.74	2.79 8.26 8.78 4.21 4.68	2.75 8.22 8.68 4.15 4.61	2.71 3.17 3.68 4.09 4.54	2.67 8.12 8.58 4.03 4.47	2.63 3.06 8.53 8.97 4.41	2,59 8,04 8,48 8,91 4,85	2.99 8.42 8.85 4.28	3.36	
11 12 63 14 15	5.66 6.19 6.71 7.23 7.76	5.59 6.11 6.62 7.14 7.66	5.51 6.02 6.53 7.65 7.56	5. 44 5. 94 6. 45 6. 95 7. 46	5.87 5.86 6.36 6.86 7.86	5.80 5.78 6.27 6.76 7.26	5.22 5.70 6.18 6.67 7.16	5. 15 5. 62 6. 10 6. 58 7. 06	5,08 5,54 6,01 6,48 6,95	5.00 5.46 5.92 6.89 6.85	4. 98 5. 88 5. 88 6. 29 6. 75	4.86 5.80 5.75 6.20 6.65	4.79 5.22 5.66 6.11 6.55	5 14	4. 68 5. 06 5. 49 5. 92 6. 85	4, 56 4, 98 5, 40 5, 83 6, 25
16 17 18 19 20	8, 29 8, 82 9, 85 9, 87 10, 41	8. 18 8. 70 9. 22 9. 75 10. 27	8. 07 8. 59 9. 10 9. 62 10. 14	7.96 8.47 8.98 9.49 10.00	7.86 8.86 8.86 9.36 9.87	7.75 8.24 8.74 9.23 9.78	7.64 8.18 8.62 9.11 9.60	7.54 8.02 8.50 8.98 9.46	7.48 7.90 8.37 8.85 9.82	7.82 7.79 8.25 8.72 9.19	7. 21 7. 67 8. 13 8. 59 9. 05	7.11 7.56 8.01 8.47 8.92	7.00 7.45 7.89 8.84 8.78	6.89 7.83 7.77 8.21 8.65	6.78 7.21 7.65 8.08 8.51	6.68 7.10 7.52 7.95 8.88
<del></del>	-				Ba	romet	rie pre	esure,	P, in	millin	eters.					
	610	600	590	580	570	560	550	540	530	520	510	500	490	480	470	460
0 2 8 4 5	0.41 0.81 1.23 1.62 2.08	0.40 0.50 1.20 1.60 1.99	0.40 0.78 1.17 1.57 1.96	0.89 0.77 1.15 1.54 1.98	0.88 0.76 1.13 1.51 1.90	0.88 0.75 1.12 1.49 1.86	0.87 0.78 1.10 1.46 1.88	0.36 0.72 1.08 1.44 1.80	0.36 0.70 1.06 1.41 1.76	0.35 0.69 1.04 1.88 1.73	0.84 0.68 1.02 1.86 1.70	0.84 0.67 1.00 1.83 1.66	0. 83 0. 65 0. 98 1. 80 1. 63	0.64 0.96 1.28	0.62 0.94 1.25	0.31 0.61 0.92 1.22 1.53
6 7 8 9	2.43 2.84 8.26 8.67 4.07	2.89 2.80 3.20 3.61 4.01	2.85 2.75 8.15 8.55 3.91	2, 82 2, 71 8, 10 8, 49 8, 88	2. 28 2. 66 3. 04 3. 43 8. 81	2.24 2.61 2.99 8.87 8.74	2. 20 2. 56 2. 94 8. 81 8. 67	2. 16 2. 52 2. 88 3. 25 8. 61	2.12 2.47 2.83 8.19 8.54	2.08 2.43 2.78 8.13 8.48	2.04 2.88 2.72 8.06 8.41	2.00 2.83 2.67 8.00 8.84	1.96 2.28 2.62 2.94 3.27	2. 24 2. 56 2. 88	1.87 2.19 2.51 2.82 3.14	1.83 2.14 2.45 2.76 8.07
11 12 23 11 15	4.49 4.90 5.81 5.73 6.15	4. 42 4. 82 5. 23 5. 64 6. 05	4.84 4.74 5.14 5.54 5.95	4. 27 4. 66 5. 05 5. 45 5. 85	4. 19 4. 58 4. 96 5. 85 5. 74	4. 12 4. 50 4. 88 5. 26 5. 64	4.05 4.42 4.79 5.17 5.54	8.97 4.84 4.70 5.07 5.44	8.90 4.26 4.62 4.98 5.81	8, 83 4, 18 4, 53 4, 88 5, 24	8.75 4.10 4.44 4.79 5.14	8.68 4.62 4.86 4.70 5.04	8,60 8,93 4,27 4,60 4,94	8.85 4.18 4.51		8.70 4.01 4.82
16 17 18 19	6.57 6.98 7.40 7.63 8.24	6.46 6.87 7.28 7.70 8,11	6.85 6.75 7.16 7.57 7.97	6.24 6.64 7.04 7.44 7.84	6.14 6.53 6.92 7.81 7.70	6.08 6.41 6.80 7.18 7.57	5.92 6.80 6.67 7.05 7.48	5.81 6.18 6.55 6.98 7.80	5.71 6.07 6.48 6.80 7.16	5.60 5.95 6.81 6.67 7.08	5.49 5.84 6.19 6.54 6.90	5.88 5.72 6.07 6.42 6.76	5.27 5.61 5.95 6.29 6.62	5. 17 5. 50 5. 83 6. 16 6. 49	5.88 5.70	5.56 5.90

## APPENDIX 25.

REPORT OF JUNIOR PROFESSOR H. A. HAZEN, SIGNAL SERVICE, ON THUNDER-STORMS.

STUDY ROOM, SIGNAL OFFICE, November 11, 1885.

SIR: In accordance with your note upon my paper, entitled "Thunder-storms of 1884." I have carefully combined into mean maps the various charts in my former paper. The charts were originally intended to show that precisely the same effects were to be noted in different series as well as in a general mean, which frequently hides the very quantity we seek, but in the present instance there will be no loss by the condensation since it exhibits the same result as the individual maps. I have added tables which will enable any one who so chooses to project all the individual maps. I have had the paper rewritten, so that any one desiring to study the original manuscript and maps can do so.

Very respectfully,

H. A. HAZEN.

The CHIEF SIGNAL OFFICER OF THE ARMY.

#### THUNDER-STORMS OF 1884.

A systematic observation of thunder-storms in this country was begun by the Smithsonian Institution in 1849. These observations were kept up until 1873, when the work was given to the Signal Office, which had begun observations at its stations in 1871. In January, 1884, after a conference with the Postmaster-General, it was decided to undertake a more detailed study of these storms. The accompanying circular and card were sent to the post-offices 40 miles apart north of 35° north latitude and east of the one hundred and second meridian from Greenwich. For a still more detailed study, cards were sent to post-offices 10 miles apart in Illinois and Indiana, and within 150 miles in all directions from Washington.

[Circular No. 4.]

SIGNAL OFFICE, WAR DEPARTMENT, Washington, March 1, 1884.

It is desired that during the summer of 1884 a few simple facts be collected relating to the important subject of thunder-storms. To this end post-offices and other centers have been selected, over a limited extent of country, at distances of about 10 miles. Each station, it will be readily seen, forms an important point in the net-work of stations, and by a comparison of these observations it is hoped that valuable acquisitions may be made to our knowledge of these frequent accompaniments of tornadoes. Each thunder-storm should have some note made of it, in order that there may be no gap in any region.

The following instructions are given for guidance in making observations. Each card will have sufficient space for five storms. Give town, county, State, time (whether "mountain," "central," "eastern," or some city), and name of observer.

Thunder-storms twelve hours apart may be taken as separate storms. Upon the occurrence of thunder give, in the appropriate spaces, month and day, and, as near as pos-ible, the time of first and last thunder connected with the storm. Frequently after a storm has passed there will be muttering of thunder, but care should be taken to, as far as may be, watch the single storm.

Give the direction from which the storm appears to be coming, as shown by threatening sky, lightning flashes, or thunder peals. Also, the direction towards which it goes.

Give time of beginning and ending of rain, with amount, if possible.

If the rain continues rather heavy more than two hours after the loudest thunder has passed, it may be marked "more than two hours."

The amount of rain can be measured, with a common rule, after it has been caught in a pail or empty tomato can with vertical sides.

All observations of hail, size of stones, &c., are very important.

Give directions and force of wind before and after the thunder-storm; for the force adopt the scale, calm, light, moderate, brisk, high, very high, hurricane or tornado.

If you have a thermometer, give the shade temperature, or temperature on the north side of house, a little before the storm reaches the station as well as after it has passed. Note, also, if on any day heat-lightning is seen, the date, time of appearance, and direction.

If there is not time for a full report, give date and time of severest part of thunderstorm. Please do not fail to make some note of every distinct thunder-storm that passes over or within ear-shot of the station.

Observations should begin immediately upon the receipt of the cards.

Please return one of these cards on July 1 and another on September 1, even if there is no record other than town, county, State, and name.

This circular is issued with the sanction of the Postmaster-General.

If you know some one in your immediate neighborhood who takes an interest in meteorology and would be willing to report, you are at liberty to hand these cards to him.

W. B. HAZEN.

Brig. and Bot. Maj. Gen'l, Chief Signal Officer, U. S. A.

[Form 169-1885.]

#### THUNDER-STORMS.

#### [Data collected by co-operation of Post-Office and War Departments.]

Jate (month	and day)			•		
	First he	ard	***************************************			
Fhunder	Londes	<b></b>	•••••••			
	Last he	ard	••••••			
Direction	,	'		1		
				1		
Dain						
A-111						
	Began					
Hail	1			1		
	( Amoun					
	Before	Direction				
Wind	}	Direction	•••••			
	(227001	Force	••••••			
Scale				······	···	

Only two cards left. Make ( ) cross.

Several interesting storms having occurred in May, a paper was written upon them and presented to the American Association for the Advancement of Science, at its Philadelphia meeting in September, 1884; it was afterwards published as Signal Service Note No. XX. A further study of the records of separate storms for 1884, of which more than thirteen thousand were filed, has developed the facts presented herewith.

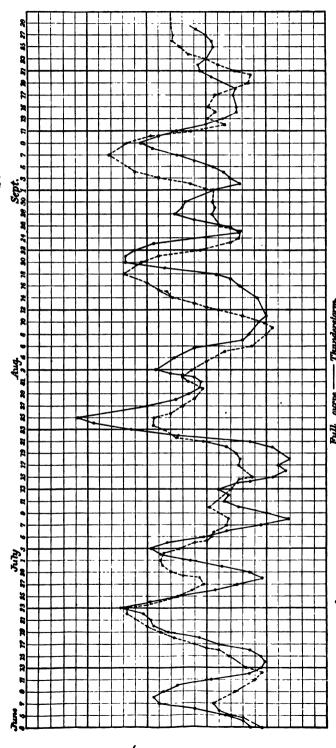
#### THUNDER-STORMS AND TEMPERATURE.

All the records were grouped by each day from May 1 to October 31, and their frequency for each day is shown in Table I; there is also shown in the same table the mean temperature over the whole region of observation. The method of obtaining this mean temperature was as follows: A plate of glass covering the whole region had drawn upon it squares of 2°.5 east and west as well as north and south; this plate was laid upon the daily maps in succession and the temperature of each square obtained from the isotherms. The mean temperature of all the squares gave that of the whole country. If the figures be projected graphically a remarkable coincidence will be found, a maximum of storms occurring usually a little later than that of temperature. In order to eliminate the effect of seasonal change on the temperature and also to smooth out the great irregularities, Table II has been prepared in the following manner: First, the departure from the monthly mean number of storms for each day was prepared, as well as for temperature; next a five-day mean was taken for both storms and temperature from these figures.

TABLE I.—Number of thunder-storms and mean air temperature for the region of observation from May to October, 1884.

	r of	Ju	ne.	Ju	ly.	Aug	ust.	Septe	mber.	noda .
Day.	May, number of storms.	Number of storms.	Mean temp.	Number of storms.	Mean temp.	Number of storms.	Mean temp.	Number of storms.	Mean temp.	October, number of storms.
1	23 20 15 44 59	80 62 84 43 52	58. 7 58. 0 61. 0 61. 0 62. 3	149 186 188 205 178	69.0 67.7 68.8 68.3 64.3	62 96 116 209 67	65.0 68.3 67.0 61.0 59.7	22 31 42 • 85	60.0 61.3 67.7 66.7 70.7	21 19 21 61 85
6	43 16 19 44 85	100 127 218 193 84	63.0 66.7 67.3 62.3 55.0	71 38 82 78 53	68. 8 62. 0 65. 8 64. 8	40 38 55 23 60	61.7 61.7 55.7 57.8 57.7	45 87 114 116 187	69.7 66.0 72.8 69.0 69.3	29 26 42 20 8
11	26 64 66 82 28	52 63 74 89 86	60.7 65.0 61.7 60.7 60.8	169 153 126 68 93	66. 0 67. 0 62. 8 61. 0 62. 0	28 15 18 81 68	59. 3 64. 0 65. 8 66. 0 67. 7	91 29 21 19 48	62.7 55.8 56.3 55.7 61.8	8 49 16 9 7
16	24 50 94 122 70	34 82 108 177 113	64.3 67.8 68.0 68.3 69.7	51 39 80 102 45	61.8 63.0 63.7 68.8 61.7	46 48 66 69 116	69.8 68.8 70.0 72.7 72.7	29 29 29 25 42	59.0 58.7 54.8 54.7 53.0	26 6 8 12 10
11	63 87 121 91 65	167 140 117 219 200	70. 7 72. 0 78. 8 78. 7 <b>69</b> . 8	71 91 219 860 251	63. 0 68. 8 72. 7 73. 0 67. 7	275 193 65 43 40	67. 8 62. 7 59. 7 60. 8 60. 0	62 90 83 29 19	51.7 59.8 61.7 61.0 56.8	19 25 5 3
26	81 112 32 24 16	46 32 80 48 92	58.7 62.7 67.0 68.3 70.7	225 155 175 182 122	67. 7 68. 8 65. 8 65. 7 66. 0	61 50 108 143 169	62.7 62.0 65.3 65.3 61.7	51 78 81 88 74	56.0 63.8 65.3 60.7 59.8	4 1 0 2 9
n	28			167	66.0	25	60.7			0
Mean	52	97	65.0	133	65.5	79	65.7	55	61.4	16

FLUCTUATIONS OF TEMPERATURE AND THUNDERSTORM FREQUENCY.



Appendix 25, Signal, 1886.



TABLE II.—Departure from mean monthly values of storm frequency and mean temperature, with 5-day means of same.

				Daily	ralues	•				-	Fi▼	e-days	mea	ns.		
	Ju	ine.	Jı	ıly.	A	ug.	Se.	pt.	Ju	ne.	J	uly.	A	ug.	8	ept.
Day.	Storms.	Temp.	Storms.	Temp.	Sterms.	Temp.	Storms.	Temp.	Storms.	Temp.	Storms.	Temp.	Storms	Temp.	Storms.	Temp.
1 2 3 4 5	-17 -35 -18 -54 -45	-6.2 -6.9 -3.9 -3.9 -2.6	16 53 55 72 40	0 4.5 2.2 2.8 2.8 -1.2	-17 17 35 131 -10	0 1,2 4.5 8.2 -2.8 -4.1	-33 -24 -13 -14 -20	0 -1.4 -0.1 6.3 5.3 9.8		-4.7 -3.8 -2.1	13 88 47 82 2	8.7 8.6 7.2 .9	12 40 82 27 16	0 1.8 1.3 -4 3 -1.6	- 7 -28 -21 -16 - 5	0 1 1.4 8.9 5.8 6.8
6 7 8 9 10	30 121 96 —13	-1.9 1.8 2.4 -2.6 -9.9	-62 -93 -51 -55 -80	-2.2 -3.5 2 -1.2 -1.5	-39 -41 -23 -56 -19	-2.1 -2.1 -8.1 -6.5 -6.1	-10 82 59 61 82	8.3 4.6 10.6 7.6 7.9	11 41 47 88 25	-0.8 6 -2.0 -2.5 -2.8	—19 —45 —69 —49 —26	9 -1.7 -1.9 -1.2 2	4 34 36 38 43	-3.8 -4.6 -5.0 -5.5 -5.5	9 24 45 54 42	7.7 8.1 7.9 6.5 4.3
11 12 13 14 15	-45 -34 -23 -58 -61	-4.2 -5 -3.2 -4.2 -4.6	36 20 - 7 -(5 -40	.5 1.5 -3.2 -4.5 -3.5	-51 -64 -61 -48 -11	-4.5 .2 1.5 2.2 3.9	36 26 34 36 7	1.8 -6.1 -4.9 -5.7 1	- 4 -35 -44 -48 -41	-4.0 -4.3 -8.2 -2.5 -2.0	—17 —19 —11 —35 —58	8 -1.4 -1.8 -2.8 -3.6	-50 -49 -47 -43 -37	-3.1 -1.3 .7 2.7 8.5	24 4 13 26 26	1.2 -1.5 1 8 2
16 17 18 19 20	-68 -15 11 80 16	6 2.4 8.1 8.4 4.8	-82 -94 -53 -31 -88	-4.2 -2.5 -1.8 -2.2 -3.8	-83 -31 -13 -19 47	5.5 4.5 6.2 8.9 8.9	-26 -26 -26 -30 -13	-2.4 -2.7 -9.1 -6.7 -8.4	-37 -10 6 82 44	8 .7 2.6 8.9 4.8	61 60 70 60 55	-3.8 -2.8 -2.9 -2.6 -1.6	-27 -20 - 8 38 67	4.5 5.8 6.8 6.4 5.3	-24 -23 -24 -18 -5	6 8 -2.5 -3.9 3.8
21 22 23 24 25	70 43 20 122 108	5.8 7.1 7.4 8.8 4.4	-62 -42 86 227 118	-2.5 2.8 7.2 7.5 2.2	196 114 14 36 39	3.5 -1.1 -4.1 -3.5 -3.8	7 35 28 -26 -36	-9.7 -2.1 .3 4 -3.1	46 54 72 47 26	5.7 6.8 6.7 4.3 2.4	-27 24 65 96 109	.8 2.2 8.4 4.4 4.4	67 61 44 1 —27	8. 2 . 7 1. 8 2. 7 2. 9	5 6 2 -1 -8	-2.8 1.1 .0 1.3 2.1
25 27 28 29 20	구등 구등 구 등 구 5 	-6.2 -2.2 2.1 3.4 5.8	92 22 24 - 1 -11	2.2 2.8 2 .2 .5	-18 -29 29 65 90	-1.1 -1.8 1.5 1.5 -2.1	- 4 23 26 -15 19	-3.4 1.9 3.9 7 -2.1	- 8 -27 -48 -35 -11	1.4 .3 .6 2.7 3.6	97 51 25 14 16	2.9 1.4 1.1 .8 .4	-19 2 27 20 19	-1.7 7 4 8 7	-8 -1 10	2.8 2.7 2.9
31		<b></b>	····	.5	<b>54</b>	-3.1	<u>.</u>	··········		 	4	1.4	9	-1.0	   <b>-</b>	•••••••

In order to present the facts developed in an easy form for comprehension, Fig. 1 has been prepared showing the five-day mean of storm frequency and mean temperature fluctuations. These curves exhibit a remarkable uniformity and show clearly an interdependence between high temperature and a relatively large number of thunder-storms. The maximum points in the temperature curve seem to precede the same in the storm frequency by one or two days (Fig. 1). In order to study this question more closely, there were selected out thirty days in May, June, July, and August having the greatest number of storms in each day, and in like manner thirty days having the least number. Taking groups of ten days each, the mean temperature for each group from the Signal Service observations was obtained, and in like manner for each 10-day group of few storms. These results are embodied in Table III.

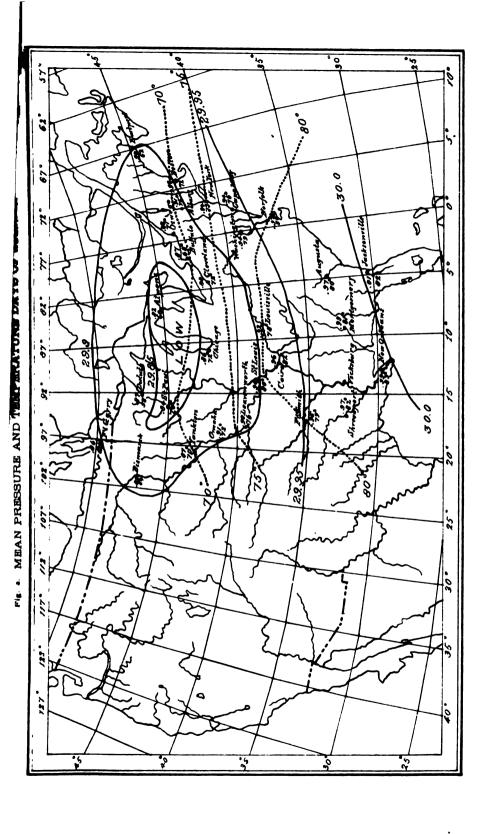
TABLE III. - Mean 10-day temperatures at selected stations.

		Day	rs of sto	rms.			Days	of fow st	orms.	
	7.	00.	15	.00,		7.0	00.	15.	.00.	
	First set.	Second set.	First set.	Second set.	Mean.	First set.	Second set.	First set.	Second set.	Mean.
Boston	69	68	72	77	72	63	64		72	64
Eastport	59	60	62	66	62	56	52	54	63	56
Albany	71	71	80	80	76	65	65	64	74	67
New York City	71	72	76	80	75	65	66	64	75	68
Norfolk	77	76	82	87	80	72	72	70	78	73
Philadelphia	71	72	79	84	76	66	65	65	75	68
Washington City	74	72	84	86	79	66	66	68	79	70
Augusta	75	74	84	87	80	76	72	80	86	78
Jacksonville	80	78	83	88	82	79	75	81	87	80
Montgomery	76	74	88	87	81	76	69	80	87	78
New Orleans	81	80	84	87	83	82	77	79	90	86 77
Fort Smith	75	70	79	91	79	78	67	78	89	77
Indianola	80	78	82	89	82	79	78	80	89	82 80 70
Shreveport	80	76	84	[89]	82	78	68	79	93	80
Cincinneti	77	78	77	87	78	67	65	70	80	70
Memphis	79	76	81	92	82	7.5	70	74	85	76
Pikaburg	72	69	80	83	76	64	60	68	78	68
Bunalo	66	69	68	70	68	74	60	58	66	64
Cleveland	70	68	78	75	72	64	61	61	69	64
Oswego	66	69	78	71	71	54	61	55	63	58
Alpena	58	62	59	[62]	60	55	57	55	66	58
Duluth	59	60	58	59	58	60	61	58	63	68
Davenport	70	67	71	78	72	(A	64	69	76	68
Saint Louis	74	72	77	85	80	70	67	68	80	71
Saint Paul	65	64	70	79	70	61	62	73	78	68
Leavenworth	78	69	<b>、78</b>	87	76	- 70	65	71	84	68 76 72 71 68
Omaha	70	61	72	81	72	68	65	72	82	72
Yankton	64	63	78	80	70	63	<b>6</b> l	75	84	71
Bismarck	58	54	70	78	64	60	63	74	74	66
Saint Vincent	56	52	69	l 70 l	62	54	58	70	70	63

Each set of 10 days was projected upon separate charts for study, but, for the purpose of this paper, it has been deemed sufficient to give only the means for 30 days. (See the dotted curves on Figures 2 and 3.) A careful study of these curves shows somewhat higher temperatures on days of many storms than on days of few storms, as has already been shown. These contrasts would have been somewhat greater if the day before that of the greatest number of storms had been selected as already shown in Fig. 1. There seems to be no marked increase in temperature toward the south, or, in other words, there are no great contrasts of temperature from north to south, but rather a uniform increase over the whole region.

#### THUNDER-STORMS AND RELATIVE HUMIDITY.

In the same way as with the temperature above, the relative humidity was computed for each 10 days and projected upon maps. The results show only a slight difference for days of storms as compared with days of few storms. The dew-point temperatures for 20 days and at 15^h have been selected out in the same manner and are given in Table IV.



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P.S. 3.--MEAN PRESSURE AND TEMPERATURE DAYS OF FEW STORMS.



TABLE IV .- Mean 10-day deve-point at selected stations.

	Da	ys of stor	ms.	Days of few storms			
	First set.	Second set.	Mean.	First set.	Second set.	Mean.	
oston	58	64	61		56	5	
astport	49	54	52	38	55	4	
	57	62	60	89	49	l ā	
lbany ew York City	53	66	70	45	53		
	63	78	68	52	64	5	
orfolkhiladelphia	71	78	72	52	60	ì	
ashington City	64	1 71	68	50	52	1 6	
	94	72	83	58	57	7	
ugusta	69			64	74		
cksonville		78	71				
ontgomery	63	71	67	61	68		
ew Orleans	67	71	69	64	72		
ort Smith	59	70	64	56	71	!	
dianola	78	75	74	68	76	1 3	
reveport	69	72	70	67	78	1	
ncinnati	60	66	63	51	51	1 1	
emphis	61	78	67	59	70	(	
ittsburg	60	64	62	48	50		
uffs.lo	68	[68]	66	40	52		
leveland	56	62	59	44	50	1 .	
swego	58	60	59	41	54	į (	
lpena	49	51	50	88	46		
uluth	48	52	48	40	52	1 4	
svenport	58	67	62	49	56	1 :	
int Louis	59	72	66	54	65		
int Paul	57	64	60	56	63	1	
es ven worth	54	67	60	48	66	1	
maha	58	68	68	54	67	1	
ankton	51	1 84	58	50	66		
ismarck	50	56	58	49	63	1	
int Vincent	30	1 00	1 00	52	59	l	

These were also projected upon charts and studied. The results showed a normal condition of the dew-point and vapor-tension during both classes of days with and without storms. The charts have not been reproduced in this publication, but they may be readily made from the table. It will be found that the dew-points have a little higher tendency on storm days, but it should be noted that this is due to the higher air temperature on those days. These computations show that the moisture contents of the air just before the approach of a thunder-storm are but little changed. This rather surprising result has been noted in individual observations; very frequently the sling psychrometer has exhibited no change in humidity as the storm came up; sometimes by swinging under an umbrella it has been possible to determine this even after rain has begun falling. The same data regarding the weather were also prepared, showing no marked contrasts between days of storms and few storms.

# THUNDER-STORMS AND AIR PRESSURE.

The mean 7 a. m. air-pressure in groups of 10 days was determined as in the previous cases and is exhibited in Table V.

TABLE V.-Mean 10 days' air pressure at selected stations.

		Days of	storms.	•	Days of few storms.						
	First set.	Second set.	Third set.	Mean.	First set.	Second set.	Third set.	Mean.			
Boston	.90	.85	.04	.93	.10	.87	.08	.0			
Eastport	.86	.82	.38	.90	.02	.75	.07	i õi			
Albany	.87	.83	.02	.91	.11	.86	.ii	i .õ			
New York City	.92	.87	.04	.94	.12	.92	. io	ı ä			
Norfolk	.93	.92	.07	.97	.12	.97	.06	i ä			
Philadelphia	.92	.87	.04	.94	. 18	95	.09	.õi			
Washington City	.92	.87	.04	.94	.13	97	.09	i ä			
Augusta	. 96	.86	.00	.97	.08	.98	.07	i .õ			
Jacksonville.	.96	.99	.08	.oi	.03	.96	.99	. 95			
Montgomery	.93	.96	.08	99	.01	[.97]	.04	.0			
New Orleans	.94	.98	.04	.99	.97	.98	.99	.90			
Fort Smith	.92	.88	.04	.95	.õi	.96	.08	i ã			
Indianola	.91	.97	.00	.96	.97	.99	.97	9			
Shreveport	.91	.95	.05	.97	.oi	.99	.05	l ô			
Cincinnati	.88	.86	.02	.92	. ii	.03	. 10	l iõi			
Memphis	.92	. 91	.04	.96	.07	.01	.08	.0			
Pitteburg	.77	.83	. 98	.86	. 10	.98	.06	. ČE			
Buffalo	.86	. 83	. 91	.87	.11	. 96	.08	. Ot			
Cleveland	.85	.83	.95	.88	.12	.03	.08	i o			
Oswego	.88	.84	. 98	.88	.15	.94	.10	i .oc			
Alpena	.86	.78	.86	.82	.13	.01	.01	l ä			
Duluth	.92	.85	. 83	.87	.07	.99	. 98	.01			
Davenport	.84	.83	. 91	.86	l iii	.08	.02	. ot			
Saint Louis	.86	.86	.99	.90	.10	.08	.08	.07			
Saint Paul	.82	.83	. 86	.84	.07	.01	. 97	.05			
Leavenworth	.88	.86	.96	.90	.08	.97	.00	l ä			
Omaha	.89	.97	.97	.91	.10	.96	.00	i õi			
Yankton		.86	.88	.87	.05	.93	.01	Ö			
Bismarck	.91	.85	. 92	.89	.94	.84	. 91	90			
Saint Vincent	.90	82	. 86	.86	.95	.89	.86	:90			

The 30 days' mean has been projected in the full curves of Figs. 2 and 3. We find that Fig. 2 shows in a marked degree a low area to the north and northwest of the region of greatest frequency of thunder-storms, and its center at a distance of about 350 miles. Fig. 3, however, is just the reverse, showing a high area to the north and northeast of the thunder-storm region. These results are exhibited on each of the groups of ten days. To sum up these results, we see (1) that the humidity and weather conditions are but slightly, if at all, affected on days of thunder-storm action, which would seem to show a concentration of unusual rainfall action at the time of thunder-storms rather than a general rain such as might be expected in connection with the prominent low area, which is almost invariably present. (2) The temperature, while showing no marked contrasts in a north and south direction, yet does show a fair increase on days of most storms. The date of this increase is slightly in advance of that of the greatest number of storms. (3) The most marked characteristic, however, is the presence of a low area to the north and northwest of greatest thunder-storm action, and its replacement almost exactly by a high area on days of few storms. This goes to show that, in the United States at least, there is a very notable connection between a low area and thunder-storm action.

It is evident that a thorough study of some general storm action and its accompanying low area must give an important addition to our knowledge. Such a study demands exact knowledge as to the time of beginning and ending of storm action, rain and wind, as well as the gaps (if there be such) in all these phenomena occurring to the southeast of a low area. A beginning of such study has already been made, and has revealed some very surprising results. The storms of May 18 and 19, 1884, were wide-spread over the region of observation. They began on May 18 in Illinois, reached a maximum of action at 16^h, then died down at night to begin again the next day at a point somewhat to the east of the starting point of the previous day. The velocity of the low area was about 21 miles per hour, while that of the thunder-storms was 41 miles per hour.

This enormous increase in the velocity is difficult to explain, and demands further investigation. It would seem to show that while the action is coincident with the presence of a low area, yet it is largely independent of it. Possibly the low area serves as a medium of concentration of the electrical action in it is southeast quadrant, while the effects of this action are separate from the influence of low pressure. There seems to be very little doubt that thunder-storm action is downward from the upper atmosphere.

A normal storm is frequently ushered in by a very sudden gust of wind, which has been blowing gently from the south all day in accordance with the usual barometric gradient, toward the low area. With this high wind there comes a rise in pressure which reaches a maximum at the same time as the maximum of the storm. As the storm advances the lightning and thunder increase, and after it passes the wind dies down very markedly. That there is a down rush in the center of a thunder-storm is proved by the fact that if the storm is to the south the wind is very strong from that direction, while if it is toward the north the wind is just as strong from the north, although it may have been blowing gently from the south up to the time of the storm.

# AIR PRESSURE IN THE CENTER OF A STORM.

During 1883 and 1884 the writer watched with great care every thunder-storm as it came up and passed off, counting the distance in every case where the lightning and thunder were distinct and could be connected. These records, together with the barograph curves of the Signal Office, will enable us to determine whether there is any marked effect on the air pressure or not on the approach and passage of a storm. Table VI contains records taken from the barograph trace every fifteen minutes, and oftener whenever there was a great fluctuation.

TABLE VI.—Observations of barograph on thunder-storm days 1883 and 1884.

Aug. 23. 15-	29.800	797.	800 800	86.0	388	86. 848. 878.	8	148.	970	.807	908	88.	28	86.6	814	88	88
July 28, 20.	29.835	g. 28.	88.	888	018.	28.	.873	7808	88.	98.	8	988.	.876	.878	F. 8	88	88
July 24, 14b.	29.667	2 2 2 3 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5	128	3.5	88	3.3	ş	88	83		718	202.	16.	86	8	\$17.	
July 15, 164.	29.671	. 8i		38	829.	879.	3.5	3	8	8		88	\$		<b>8</b> .	ş.	
July 13, 15.	28.62	133	2.2 2.3	£	}	£79.	305	88	8.5	12	Š.	Ë	<u>.</u>				
July 8, 141,	8. 67	888	<b>99</b> .	8	88	8.	Ē	Ė	<b>8</b>	28		<b>8</b> .	8	<b>8</b>	8	.678	
July 6, 186.	20.878	<b>8 8</b> .	. 882	878	<b>3</b>	88.	<b>88</b> .	8.	200	8	8.	<b>8</b> .	86.	88.	<b>8</b> .	<b>8</b> .	
July 5.	20.963	87.6	98. 88.	.888	<b>3</b> 26.	. 963	28. 28. 28. 28. 28. 28.	889	29.800	8.	75	3	88.	28.	. 962	88.	
June 29, 14h.	29.74 212.	8. Z.	.700	88.	.718 .726	927.	.730	.744	726	127.	82.	027.	127	<u> </u>	•		
June 21, 20.	29.757	8 E	808.	8	282	.79	<b>8</b> 8.	900	98	98.							
June 19, 2 ^b .	20.70	5 22	1887.	92.	14.	.718	717.	027.	. 754	.760	.718	. 25.	88	.70			
June 16, 21b.	30.006	8. 8.	200	29.98	3.8	88	8	870.	8	<b>38</b> .	8	8.	8.	29, 996	8.	\$ 3	
June 13, 16º.	29.630	. 614 . 614	. 908	39.	99. 889.	2.9. 8.3.	843	. 646	. 663		***************************************	******		***************************************			
June 10, 20.	29.600	.597	99.	010.		.640	.043	25	979								
May 22,	29.343	333	828	878	323	888	, gil	898	.348	£.							
May 21, 14h.	. 23.	388	•	8.8	88	2002	E'S	7.5	88	8.5	88	123	722	97	83	88	
May 5, May 21, Ma	29.406	<b>182</b>	\$\$	<b>1</b>	EEE	. 877	\$ 8	\$	<b>88</b> .	88.							
May 5.	× 30.044	9 0	440	.007	988	88.	88	85	.078	.078	.078	.078	88			00	
Time.	A. m. 00 30.044	9 8	\$	1 00	15	8		2 00	15	30	<b>5</b>	3 00	15	30	\$	4 00	83

Aug. 30, 154.	29.637 .637	<b>159</b>	.637	689	83.	.627	. 642	150	979.	.636	.642	9.	839	819	879.			
Aug. 21, 139.	29. 939	916	116.	906	8.	006	716.	33	716.	206	206	86.	988.	988.	88.	788.	788.	
July 29, 139.	29.545	.587	. 586	5424	. 528	.507	.524	883.	.542	. 543	.542	.641	75.	. 550	.560	.576 878	583	
July 24, 16.30*.	29.744	.787	788	787	188.	.887	. 8624	788.	98.	23	.1	8	Ę	792	.786	88	. 79C 818	
July 11, 136.	29.742 .772	18	737	27.	748	. 184	35.	746	747.	, j	20.5	32	797.	786	92	188	25. 28.	
July 1, 19.	85. 25.	. 28.	.780	.824	. 810	88	88	788.	88	83	88.	.817	788	38	787.	E.		
June 10, 211.	29.724 .740	.756	.758	.760	.768	.766	1774	. 75	.807	908	787.	787.	787.	707.	96	8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8	25.5	
May 24, 196.	29.719	85	7.	.740	.7584	758	3.5	£.	£.	92	.738	.758			•			
May 23, 19.	29, 897	106	106	706	88	38	88	88	76.	98	.874	.874	106	808	808	208.		
May 19, 166.	29. G8 . G38	88	. 646	979	. 646	88	289.	7002.	95	.676	8	8	88	.70	902.	827.		
May 5, 195.	29.798 .790	808	908	778	. 843	828	728.	8.	26.5	38	768	. 846	<b>738</b> .	98.	.807	8.8	.788	
Apr. 2, 129.	29. 167 . 166	174	106.	202	161.	222	Ä	88	.215	.180	908	ğ	.18	.182	.180	178	888	
Mar. 26, 14 ^h .	29. 496 .488	<b>8</b>	\$	518	8	.480	97			•	***************************************				•			
Mar. 9,	29.976 .969	926	80.08	38.	116.	. 8.3	85	8	88	816.	88.	8	916	8	8			
Feb. 23, Ob.	29.828 .820	918.	.815	Ž.	£1.	.766	257.	28	, E	28	217.	8	929					
Feb. 14, 54.	29. 588.	38.	282	.578	592	983	888	38	<b>5</b> .	26.5		319	23:	: ₹:	88			
Time.	1. m. 15.		<b></b>		15	30	£	8	15	30	5		15	98	45	82	848	

1884.

In this table the hour of beginning of observations is indicated at the top of each column and the time of each record is shown on the left, i. e., the time of each record may be found by adding the hour and minute on the left to the hour at the top of each column. It should be noted that the exact time of the trace is not known to several minutes, and, moreover, the severest part of a thunder-storm may be some time in passing a given point. There will also be a slight difference in the effect if the storm passes centrally than if to either side. The place of occurrence of the storm is indicated by a t at the right of the column coincident with the time of the storm. When there were two periods of activity there are two t's. If these figures be projected in curves there will be found frequent and sudden oscillations at the time of the storm. When it is considered that in the summer-time the barograph trace is usually very uniform, these sudden fluctuations are very remarkable, and indicate a uniformly sudden rise in air pressure on the passage of a thunder-storm. It would be a matter of great interest if there were studied in this connection the movement of the high wind, the oscillation of rainfall, direction of wind, &c.

#### THUNDER-STORMS AND THE MOON.

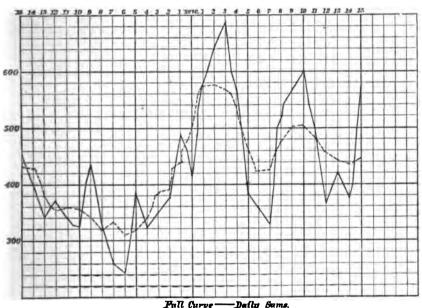
Dr. Köppen has recently published a short article in the Meteorologische Zeitschrift, which seems to show a slight effect of the moon's phases upon the frequency of storms. All the observations available for 1884 were compiled in four groups, each group containing all the storms for seven days, as follows: the center day for first group was, new moon; second, first quarter; third, full moon, and, fourth, last quarter. There were added to each of these the records for the three days immediately preceding and following the center day. Percentages were then taken for each phase of the moon. Table VII contains these results. For the purpose of comparison I have added the results obtained by Dr. Köppen.

TABLE VII .- Thunder-storms and Moon.

Phase.	Корре	m.	Signal Service, 1884.				
	No. of storms.	Per cent.	No. of storms.	Per cent.			
New	836 406 270 321	25. 2 30. 5 20. 3 24. 1	3, 538 3, 232 2, 930 2, 296	29. 5 27. 0 24. 4 19. 1			
Total	1,333	100. 1	11,996	100.0			

The above results are quite accordant, and seem to show a tendency to a greater number of storms at time of new moon and first quarter than during the other two phases. The observations of 1884 seem also to confirm the commonly-accepted theory that during the time of full moon there are far fewer clouds in summer than during the time of new moon. In order to test the question more fully Table VIII was prepared, in which the number of storms has been compiled according to each day of a lunation for five lunations.

Fig. 4.
THUNDERSTORMS AND MOON.



Full Curve — Daily Sams.

Dotted " ---- 5 Day Means.

Appendix 25, Signal, 1886.



# TABLE VIII.—Thunder-storms and the moon,

		1					
	First luna- tion.	흐흐	Third lunstion.	la-	Fifth lung- tion.		Mean of five days.
	tt Ju	김윤	- G	유유	~ 8	ایہ	0 5
	52	8 8	£ 23	3 8	중3	3	2-3
	Ē	Second lunation.	류	Fourth le	F	Total.	ğ
Days preceding new moon:			1				
15	44	127	173	41	69	454	428
14		218	71	85	40	899	427
13		198	38	45	88	840	380
12	64	84	82	87	56	873	854
11	66	52	78	114	23	333	361
10	82	63	58	116	60	824	358
9	28	74	169	137	28	436	335
8		89	158	91	15	322	318
7		86	126	29	18	259	330
<u> </u>		84	68	21	81	248	807
5		82	98	19	-68	384	314
<b>4</b>		108	51	48	46	828	887
<b>3</b>		177	89	29	48	356	885
2		118	80	29	66	375	392
N		167	102	29 25	.69	488 417	441
New moon	91	140	45	20	116	417	499
Days following new moon:	65	117	71	42	275	570	
1	1	219	92	62	198	646	561 577
Z	1	200	219	90	65	686	586
3	-	46	380	83	48	564	525
4	1	82	251	29	40	876	461
5	1	80	225	19	61	851	427
7	1 ==	43	155	51	50	827	427
	1	92	151	78	108	515	479
9		149	182	81	143	567	501
10		186	122	88	109	599	508
11	1 75	188	167	74	25	497	489
12		205	62	21	22	362	451
18		178	96	19	81	419	445
14		71	116	21	42	877	436
15		88	210	61	41	568	448
	1	1	1	1	. –	1	

The center of the table was chosen for the time of new moon, and starting with this date storms preceding and following were tabulated. The total number of storms for each day of the five lunations was computed, and the mean for each five days taken. Fig. 4 shows a projection of these values. We find from the curve of five days' means, minima at the sixth day before and after new moon, while the maxima occur at the second and tenth day after the same epoch. These results, while interesting, are not advanced here as giving any explanation. The subject seems to be sufficiently important to warrant further investigation. That the tides have some unexplained influence upon the occurrence of storms is a well defined belief along the Atlantic border and Long Island Sound. It is said by those who have studied the subject that no thunderstorms occur on a falling tide. It will be readily seen that if this be so the subject is far-reaching, and that there would seem to be a possible action of the moon which will extend over the whole earth and not merely near the sea-coast.

# THUNDER-STORMS AND SOLAR ROTATION.

In the same way as just described for the moon a table has been prepared showing the distribution of thunder-storms in respect to the period of rotation of the sun. The Royal Observatory at Greenwich has assumed the period of rotation as 25.38 days. The starting point of one of these periods is May, 15.06, 1884, and this was chosen for the first day of the present investigations. Six complete revolutions of the sun were taken, ending in October. Table IX exhibits the results and Fig. 6 shows the same graphically. The dotted curve shows a well-marked minimum on the thirteenth day of rotation and a maximum on the twenty-fourth.

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TABLE IX.—Thunder-storm frequency and solar rotation.

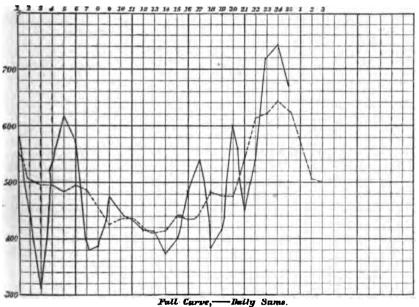
[The day of the solar rotation in the first line was May 15.06. Six complete rotations were used, counting in October.]

Down of matetion			Rota	Sum.	Hae .			
Days of rotation.	1.	2.	8.	4.	5.	6.	Juna.	Me de
1,	28	198	178	122	40	25	581	547
<b>2</b>	24	84	71	167	61	42	449	505
8	50	53	38	62	56	62	814	499
4	49	68	82	96	106	90	533	496
5	122	74	78	116	143	83	616	483
6,	70	39	58	210	109	29	570	497
7	68	36	169	000	25	19	381	486
<b>5</b>	87	84	153	40	22	51	387	452
9	121	82	126	38	31	78	476	425
10.,	91	108	66	56	42	81	446	432
11	65	177	93	23	41	88	437	437
12	81	113	51	60	-35	74	414	416
18	112	167	89	28	45	21	412	406
14	82	140	80	15	87	19	373	417
15	24	117	102	18	114	21	896	443
16	16	219	45	31	116	61	488	436
17	28	200	71	68	137	35	539	444
18	80	46	91	46	91	29	383	486
19	62	82	219	48	29	26	416	477
20	84	80	360	66	21	42	608	478
21	43	48	25t	09	19	20	445	544
22	53	92	225	116	48	8	541	609
28	100	149	155	275	29	8	716	618
24	127	186	157	193	29	49	741	645
<b>25,</b>	218	188	182	65	29	16	648	627

In absence of any apriori reason for any such fluctuation it is impossible to say of how much value these curves are. It will require many more observations of a corroborative nature to establish the truth of this oscillation. The results are sufficiently interesting to demand further study.

The above paper is given as a study of the thunder-storm observations for 1884. The observations themselves form a most valuable storehouse for future reference as questions shall arise regarding the nature of thunder-storms. It would seem as if we needed now a still more detailed study of storms over a limited region and a careful hourly plotting of the occurrences of storm, rain, wind, hail, &c., also an investigation into the connection which exists between thunder-storms and tornadoes or destructive storms.

Fig. 6. THUNDERSTORMS AND SOLAR ROTATION.



Full Curve, — Daily Sums.
Detted " ---- 5 Day Means.

Appendix 25, Signal, 1896.



# APPENDIX 26.

# INSTRUCTIONS TO VOLUNTARY OBSERVERS OF THE SIGNAL SERVICE.

SIGNAL OFFICE, WAR DEPARTMENT, Washington City, October 15, 1886.

SIR: I have the honor to submit herewith a revised copy of the instructions to voluntary observers of the Signal Service. The first edition, prepared in 1882, is nearly exhausted, and as a large number will be required during the current year to supply the numerous local organizations and State weather services co-operating with the Signal Service in collecting and distributing meteorological data, I recommend that this revision be printed as an appendix to your annual report.

I am, very respectfully, your obedient servant,

H. H. C. DUNWOODY,

First Lieutenant, Fourth Artillery, Acting Signal Officer and Assistant.

The CHIEF SIGNAL OFFICER U. S. ARMY.

Washington City.

REVIEW DIVISION, October 13, 1886.

DEAR SIR: I have the honor to forward herewith a revised copy of instructions to voluntary observers made under your direction.

Very respectfully,

H. A. HAZEN. Junior Professor, Signal Office.

Lieutenant Dunwoody.

# INSTRUCTIONS TO VOLUNTARY OBSERVERS OF THE SIGNAL SERVICE.

# INTRODUCTION.

The science of the weather is becoming more and more largely developed, and is today attracting thousands who are anxious to learn the meaning of signs and to forecast the weather in the immediate future. It is a science of which it is easy for young or old to become votaries, and every town of any size has its weather-wise. There are today many sayings of doubtful value as regards the effect of the moon, the present length of the seasons as compared with former times, the amount of rain, the depth of snow, &c., which can be checked only by long-continued and careful observations. Take the matter of rainfall alone, which is of such prime importance to the farmer. The observa-tion and record of rain is one of the easiest that can be made, and it would be of great value if we had stations 20 miles apart over the whole farming country; but, as it is, stations are about 40 miles apart, and large areas are entirely uncovered. Several of the more important observations, such as of temperature, rain, wind, thunder-storms, frosts, &c., are very simple indeed, and may be taken even by a child. It is the object of this book to give a few simple directions which will enable any one to make weather observations, to become an authority among his neighbors, and, at the same time, to aid the determination of the distribution of temperature, rain, thunder-storms, frosts, &c., as it is now being carried on at the central office of the United States Signal Service in Washington City.

Acknowledgment is made for assistance derived from Blanford's Vade Mecum, Scott's Instructions, Canadian Instructions, Loomis's Meteorology, and other authorities.

#### GENERAL CONSIDERATIONS.

In meteorological observations there are a few important considerations to be well borne in mind and to be studied before we come to the actual work of observation. in the past a neglect of these fundamental considerations has led to serious errors in observations, especially of the wind, and less frequently of temperature. It is well known that on clear nights, owing to intense radiation from the sod, its temperature is frequently lowered 15 or 20 degrees below that of the air immediately above it. This cooling of the air increases its density, and, if on a side hill, it begins flowing down to the foot of the As a result the cooler air fills up the valley at the foot, and, as this is sheldeclivity. tered from almost all wind effects, the air within becomes much cooler than the general air about. Now, as the temperature we seek is that of a somewhat extended region unaffected directly or indirectly by harmful radiation or reflection, it is evident that this condition can be fulfilled only by an exposure of the thermometer on a knoll, or at least away from a valley. Actual observation has indicated a temperature in a valley 15 to 20 degrees lower than that of the general air. In one instance a temperature at Washington was found 10 degrees lower in a valley than on a knoll 100 feet away. that no amount of expense for the immediate sheltering of a thermometer would obviate this difficulty, which is fundamental. The question of correct wind-direction and velocity depends, still more than that of temperature, on the surroundings of a station of ob-In this case we must expand our view, and take in the country for miles It is clear that no satisfactory observations of wind can be made in a valley, on a hillside, or in any situation where there are many hills around. If in locating a station it is found impracticable to avoid difficulty in this direction, then the observer should be cautioned against relying upon any local wind-vane, but should try to obtain the direction by the movement of smoke, a flag, or any other contrivance upon a neighboring eminence. As far as practicable, standard instruments should be used, and their accuracy determined by comparison with regular standards. Accurate instruments will be procured for observers at actual cost price; they will be compared with standards at this office, and correction cards furnished, free of charge. In these instructions there are given all necessary tables for use in reducing observations and making them available for direct comparison and use.

## TIME OF OBSERVATION.

It is important in meteorological observations to select some uniform times each day for making them, especially of temperature and pressure, wind and clouds. It has been found, from actual hourly readings, that the hours best suited for determining general means at any station are 7 a. m., 2 and 9 p. m., but if it be found impossible to make observations three times each day, then they may be made at the two hours of the same name, that is, 8 a. m. and p. m., 9 a. m. and p. m., &c. In the case of rainfall it is best to measure the rain, whenever practicable, immediately at the close of the rain. If maximum and minimum or self-registering thermometers are used, the time of reading may be 9 p. m., or an hour earlier or later than that. In case there are no settled hours of observation, then at the close of the day there should be noted the general cloudiness and wind direction, with any facts of general interest, relating to frost, blossoming of trees, harvest, &c.

# METEOROLOGICAL ELEMENTS TO BE OBSERVED.

The more important of these are: Air temperature, air pressure, humidity, rainfall, wind direction and velocity, thunder-storms, clouds, general observations of hail, tornadoes, aurora, and frost.

The more difficult are: Absorption and radiation of the sun's heat by the earth, evaporation, atmospheric electricity, height of clouds, and decrease of temperature with altitude.

There are also observations on the zodiacal light, solar and lunar halos, parhelia, paraselenes, and mirage, depth of ground frozen, closing of rivers, lakes and canals, and their rise and fall, temperature of the soil, of wells, and of springs, earthquakes, smoke of forest fires, dark days, hurricanes, time of budding, leafing, blossoming, ripening of plants, trees, grasses, &c., migration of birds, appearance of insects, &c., character of sunrise and sunset, and other phenomena that attract unusual attention, as the fall of fishes, frogs, &c., from the sky, red rain, &c.

## TEMPERATURE OF THE AIR.

The words heat and cold express sensations familiar to every one, and need no explanation. The latter is simply the absence of heat and not a mode of energy. These sensations are largely dependent upon the state of our bodies, and hence we are forced to adopt some invariable instrumental means for determining actual values. Since heat expands most bodies, and its withdrawal contracts them, by suitable means we might

construct a heat measurer of some metal; or, better still, by the union of two strips of metal of different expansive coefficients, such as iron and brass. The art of making such heat indicators has been wonderfully perfected in these later days, and very accurate instruments are being made upon these principles. There is one serious defect, however, in all such contrivances, and that is their liability to change their indications

in the lapse of time.
Since the volume of a gas or liquid would be changed by the application of heat, if we had some ready means of measuring this change of volume we would have a good measurer of temperature. Such an instrument is a gas or liquid thermometer in contradistinction to the one just described, which is a metallic thermometer. The gas or liquid thermometer consists of a bulb of some size, communicating with a tube more or less capillary in which the length of the column of gas or liquid is dependent upon the temperature of the bulb, hence affording an easy means of measuring changes of volume or temperature in the latter. The gas usually used is dry air, and the liquid either mercury or alcohol. The air thermometer is of great importance in obtaining a standard of thermometry, but is seldom used outside the laboratory.

#### THERMOMETER SCALES.

The two scales in common use are the Fahrenheit and the Centigrade. The former has its freezing point at  $32^\circ$  and boiling point at  $212^\circ$ . These are the fixed points of a standard thermometer, the first being the temperature of melting ice and the second that of boiling water. In the Centigrade scale these points are fixed at  $0^\circ$  and  $100^\circ$ . Since the interval between the two fixed points in the Fahrenheit scale is  $180^\circ$  and in the Centigrade scale  $100^\circ$ , it follows that  $1^\circ$ .8 Fah. is equal to  $1.^\circ$  Cent. To change the Centigrade degrees to Fahrenheit it is necessary to first multiply by nine-fifths and then to add  $32^\circ$ . In the reverse operation we must subtract from the Fahrenheit degrees  $32^\circ$ , then multiply by five-ninths. In other words—

$$F. = \frac{9}{5} C + 32^{\circ}$$
  $C. = \frac{5}{5} (F. -32^{\circ})$ 

Example: Convert 50° F. to C., we have:

$$\frac{5}{6}(50-32)=10^{\circ}$$
, hence  $50^{\circ}$  F. =  $10^{\circ}$  C.

## THERMOMETER CORRECTIONS.

It has been found that a thermometer, when graduated immediately after its manufacture, gradually changes its indications, continually reading higher and higher for several years. This may be obviated by allowing a thermometer to remain ungraduated for a term of years. After ten years the change from this cause will be practically ended.

In order to obviate the difficulty, Mr. Hicks, of London, passes the thermometers through a special treatment which eliminates the disturbing causes and produces a thermometer which has little or no liability to change. With an ordinary instrument it is necessary to determine the difference between its reading and that of a standard, and to apply that difference when great accuracy is required. Corrections are usually determined for each 10° of the scale, as follows:

Scale reading.	Correction.
0 -30 -20 -10 0 10 20 30 32 40 50 60 70 80 90	+1.0 +0.4 -0.6 -1.1 -0.6 -0.4 -0.3 -0.1 +0.3 +0.5 +0.8

This correction should be applied algebraically, as follows: At a temperature of  $-26^{\circ}$  the correction would be +0.8, that is, the thermometer reads too low  $0.8^{\circ} -26.0 + 0.8 = -25.2^{\circ}$ . At  $-8^{\circ}$  the correction is -0.3 or the reading is too high 0.3, hence  $-8.0 = 0.3 = -8.3^{\circ}$ .

It may be that as time passes the indications of a thermometer change. This can be best determined by placing the thermometer in melting chipped ice or snow and noting the reading at  $32^{\circ}$ . If it is different from that on the correction card, that difference should be applied throughout the scale. For example, suppose it be found in the case given above that the thermometer at  $32^{\circ}$  reads .6 too high instead of .4 (in this case)—0.2° should be applied algebraically throughout the scale. For example, at  $-30^{\circ}$  the correction should be +.8, at  $0^{\circ}-.8$ , &c.

If it be found that a stem-graduated thermometer is apparently reading lower than before, then a more careful test in melting ice should be made, as it ought never to read permanently lower, though heating to its extreme height for a time will tend to depress the reading. The test in melting ice need not be made more than once each year, and in a very old thermometer not as often as that. A thermometer may sometimes be found in error from a break in the column of mercury or from a bubble of air in the bulb.

A thermometer to be in the best condition ought not to have its column broken when held with bulb uppermost. To remove the air the speck in the bulb should be first brought to the junction of the stem and bulb by jarring the latter in the open palm of the hand. When the speck is at the junction, prepare ice or snow or cold water and cool the bulb down, then invert it, and all the mercury will run to the other end, or may be made to do so by a gentle jar. Now heat the bulb, either in the hand or at a long distance from a heated surface, being careful to hold the stem horizontal or inclined, with the bulb end up. This will cause the mercury to rise and drive the air before it. Care should be taken never to heat so much that the top of the column is less than a half-inch from the end of the other, as otherwise the thermometer may be broken. If now the thermometer is held vertically the two columns will join, or may be made to do so by a gentle jar in theopen palm of the hand; the air speck will be in the tube, but the mercury will join by a slender thread alongside of the speck. Now, if the bulb be cooled, the air speck will remain stationary, but the mercury will flow past it toward the bulb.

By repeating the process the speck may be finally driven into the top of the tube, where it will do no harm. In cooling off the thermometer for the last time care should be taken that the speck in the column be at a point before inversion which is above the temperature of the cooling liquid, otherwise the column left after cooling down will be so short that it cannot be driven down on inversion. If it be found impossible to get the short column down on inversion after cooling, it may be easily lengthened by jarring the bulb in the open hand, holding the bulb down. In case there is much air separating the two columns it will be found impossible to unite them when the upper column is quite short, the air-speck being so large that the thread of mercury cannot pass it. In such case it may be necessary to heat the upper part of the tube, where there is no mercury quite hot. This expands the air and brings a slight pressure to bear upon the top of the mercury. If the thermometer while still hot be jarred upon the open hand the columns will frequently unite. If all other efforts fail take the tube from the brass scale and gradually heat the part above the main column in an alcohol flame, by running it back and forth in the flame and twirling it continually in the fingers, in order to heat it uniformly.

The mercury will be volatilized and scattered along the bore. Then by heating up the thermometer the main column will take up the various detached portions. Some thermometers are provided with an expansion chamber at the top of the tube, and in such case it is only necessary to heat the bulb until the air-speck has been driven into After that, by holding the bulb down, on cooling it will be found that the air has remained behind and there is a continuous column of mercury. In the latter kind of thermometer it will frequently be found that a portion of the mercury has lodged in the chamber, and is entirely separated from the column in the tube. In such case a slight jar will sometimes send the mercury down. If this does not avail, then the bulb should be warmed till the column in the tube reaches the mercury in the chamber. When this is done, after cooling it will be found that the column is perfect. Sometimes the chamber becomes completely filled, and no effort can dislodge the mercury. is necessary to heat the chamber in an alcohol flame, being careful to turn the tube in the hand in order to apply the heat uniformly. In a short time the mercury will be expanded sufficiently to flow down the tube on its being held with the bulb down.

# ERRORS OF ALCOHOL THERMOMETERS.

There are usually used alcohol thermometers for determining the lowest temperature of the night. These are susceptible to errors which often seriously affect their readings. This thermometer has usually for its liquid alcohol, in which there floats a glass index, which is carried down to the lowest point reached during the night by the capillary action of the end of the column and left there, the alcohol passing by the index as the temperature rises in the morning. Owing to the volatile nature of the fluid.

it is frequently evaporated and condensed at the upper part of the tube, thus causing a too low reading. In transportation, also, the column is often broken into a large number of parts. To unite the column, pass a small copper wire several times through the hole at the end of the brass scale, thus forming a loop. To this tie a strong string a foot or so long and rapidly swing the thermometer through a circle the radius of the string; continue the swinging until the operation is complete. Where the column is very badly broken it may be reunited by heating the bulb in water, gradually made hotter by adding hot water, until the end of the unbroken column reaches the expansion chamber at the top; if now the bulb is gradually cooled with the tube held vertically, bulb down, it will be found that there is a complete column. Another error sometimes occurs rendering the thermometer unserviceable, in that the index is stopped in the tube by some irregularity in the bore. If this occur often the thermometer will have to be returned to the maker.

#### SENSITIVENESS OF THERMOMETERS.

A series of careful experiments has shown that a cylindrical-bulb thermometer is much more sensitive to temperature changes than one having a spherical bulb. The difference is not noticeable in the determination of air temperature, but in the case of the wet-bulb thermometer (shortly to be described) it is a matter of much importance. To those supplying themselves with instruments it is suggested that it will be important to order cylindrical-bulb thermometers for dry and wet.

#### WET-BULB THERMOMETER.

This is precisely like the dry bulb, except that it has a piece of soft muslin tied over it, which is kept constantly moistened with rain or very clean water. Observations of the wet bulb for determining the humidity are attended with great difficulty, especially in the winter season, and if one desires to make them the most careful attention should be paid to the following points: It is not advisable to attempt such observations in a window shelter, unless there is some means of artificial ventilation. This may be done by means of a bellows connected with a rubber tube, which is carried to the wet bulb; the bellows should be fastened to the bottom of the shelter and should be manipulated by a cord over a pulley carried into the room, it being necessary to keep the window shut. Another convenient form of ventilation is by rapidly rotating the thermometer either on a horizontal or a vertical axis by means of suitable cog-wheels. Another simple method of ventilation may be arranged with a fan, movable by a lever, extending into the room or below the shelter if outdoors. Experiment has shown that a fairly open shelter (shortly to be described) will give entirely satisfactory results if there be any wind stirring: but when there is little or no wind, especially with the temperature below freezing, it will be necessary to wait a long time for the wet bulb to reach its lowest reading, say twenty to thirty minutes. In such case, artificial ventilation is a great convenience, and, if no other is available, a simple palm-leaf fan may be used in any except a window shelter.

The following process will enable any one to make a perfect-fitting muslin cover to the thermometer. It applies particularly to the cylindrical bulb, but may be used for the spherical also. First cut the muslin in rectangular form of sufficient size to lap over the bulb about one-eighth or three-sixteenths inch, then wet the piece and apply immediately to the bulb. The air bubbles may readily be pressed out, and there will be a perfect fit. Take a short thread and tie the muslin above the bulb, then another thread will enable one to draw the muslin tight by first making a loop and passing it over the projecting muslin at the lower end of the bulb and gradually drawing the muslin together with the loop. A fine needle and thread will now enable one to catch the edge of the muslin so that it can never be shifted. When the temperature is above 32° moisture may be drawn to the bulb by a short wick, having one end fastened to the top of the muslin and the other dipping in a reservoir of water. When the temperature is about to fall below 32° do not take off the wick, but simply remove it from the cup and pass its end up behind the thermometer, leaving the bulb in such a position as to enable one to immerse it in a cup of water kept as near freezing point as possible. If the wick, and then place it as just directed.

In very windy cold weather it may be found necessary to immerse more than once in order to obtain a coating of ice that will not be evaporated too readily or before the lowest reading has been reached. If a wet bulb is well ventilated the lowest reading ought to be reached in a few minutes. The muslin should be changed whenever it gets brown, once in two months or so. In a very dry time it will be found that the wick running from the reservoir of water to the muslin ceases to act. In such case it is necessary to raise the reservoir in its clasp until the wick becomes nearly horizontal, when there will be no further difficulty. There is no danger of getting too much water on the wick.

Regnault found entirely satisfactory results even when the water dripped from the bulb. Great care should be exercised in keeping the bulb wet or covered with ice; a little practice will enable any one to tell at a glance whether the bulb is wet or not, though sometimes it may be necessary to touch the tip of the muslin with the finger in order to make sure of the fact. No masses of ice should be allowed to accumulate, but these should be melted off. If ice be found in the bulb left over from a previous observation, and the air temperature is above 32°, then all the ice must be carefully melted off before a correct reading can be had.

The most difficult time for making a correct observation of the wet bulb is when the temperature is just at or just below freezing. In this case extreme watchfulness is needed in order to avoid being deceived by the indications. When the bulb is first wet the mercury will go down somewhat rapidly, if the air be rather dry, until it may reach as low as 27°, when very suddenly the column will rise with rapidity, and will stand at exactly 32°. The error of a thermometer at 32° may be accurately determined by this observation. The second descent of the mercury will be found exceedingly slow, especially at the start, though when once fairly begun the column will fall quite quickly. Reading should only be made when the column has reached its lowest point. If one has artificial ventilation there will be far less difficulty. In this case it is necessary to ventilate only half a minute or so, then read and ventilate, and so continue the process till a stationary reading has been obtained or the column begins to rise.

#### MOISTURE OF THE AIR.

The moisture of the air may be expressed (1) by giving its amount in unit of volume and (2) by the ratio between the above amount and that required to saturate the air at the existing temperature. It is upon the second of these elements that our sensations of dryness and moisture chiefly depend, and it is this element which meteorologists have agreed to denote by the term humidity; or, as it is sometimes called, relative humidity. It is usually expressed as a percentage, e. g., if the amount of vapor present is  $\frac{7}{10}$  of that required for saturation the relative humidity is said to be 70 per cent. The humidity of the air may be regarded as the weight of aqueous vapor in a given quantity of air expressed as a percentage of the weight of vapor at saturation, which would occupy the same space, at the air temperature. Since aqueous vapor nearly fulfills Boyle's law, this humidity may be considered as the ratio existing between the tension of the vapor present in the air with the tension of saturated air at the actual temperature.

### DEW-POINT.

The observation is familiar to every one of a mist forming on the outside of a glass of cold water. The density of this mist depends largely on the amount of moisture in the air. It is formed in the same way as dew at night, and indicates that the air near the surface of deposition has been cooled down until the temperature has reached the point of saturation, when immediately moisture or dew begins to deposit. This temperature is called the dew-point. If the cooling is produced by a freezing mixture which lowers the temperature of the side of the vessel below the freezing point the deposition is in the form of frozen particles or frost. An approximate prediction of frost may be made in the evening by determining the dew-point; as this remains nearly constant all night if in the evening of a clear calm night, with the air temperature at 40° or even 45°, the dew-point is found at 28° to 30° frost may be expected, especially in low lands. If such a cooling takes place in a mass of air then rain or snow may be expected, according as the dew-point is above or below 32°.

### HYGROMETERS.

These may be divided into four general classes: (1) Hygrometers of absorption, or hygroscopes; (2) hygrometers of condensation, or dew-point instruments; (3) hygrometers of evaporation, or dry and wet bulb thermometers; (4) chemical hygrometers for directly determining the amount of moisture in a given volume of air.

Hair hygrometer.—The most important of the first class enumerated above is the hair hygrometer, which consists of a human hair from which all oily particles have been most carefully removed and afterward so attached to the spindle of a pointer as to indicate changes in length. This organic substance has the property of lengthening with the addition of moisture and one carefully prepared may be considered quite constant in its indications for a time. Such a hygrometer rapidly deteriorates, however, and if kept in a warm room will often take a set and give entirely erroneous results. To obviate this difficulty a hair hygrometer has been devised which may be readily brought in contact with saturated air; in this case it is possible to get a reading at each observation, or whenever desired, of the saturation point of the instrument. This instrument

has the merit of giving the relative humidity at a glance, and also of being much easier to use than the dry and wet bulb hygrometer (the psychrometer), especially with a temperature below 32°. It is almost the only instrument used in Russia under the latter condition, yet it must be admitted that it is entirely unreliable for accurate results and cannot be compared with a ventilated psychrometer. It should be noted that all methods of determining humidity become more and more difficult the lower the temperature falls below 32° and poinstrument yet devised obviates this difficulty.

falls below 32°, and no instrument yet devised obviates this difficulty.

Dev-point instruments.—A great variety of instruments have been devised for determining directly the temperature at which dew or frost will be formed. The best of these is Regnault's, which consists of a cup or prismatic box, having a highly polished face and so arranged as to permit of obtaining a very low temperature by the evaporation of a volatile liquid, such as ether, within the cup. A thermometer is inserted inside of the liquid, and its reading at the moment dew appears on the polished exterior will indicate approximately the dew-point temperature. When properly observed with a due regard to many intricate points, only to be learned by experience, this instrument may be made exceedingly accurate. The most difficult matters to arrange are: (1) Proper cleaning of the surface. (2) Position of ingress tube, as regards the thermometer. (3) Avoidance of floating vapors in the air, which would affect the plate. (4) Proper ventilation of the surface, &c. The instrument needs most careful manipulation, and can hardly be regarded as of practical use in making every-day observations in meteorology. It is most difficult to observe in low temperatures. These last remarks apply still more forcibly to the last class mentioned above—chemical hygrom-

## DRY AND WET-BULB THERMOMETERS OR PSYCHROMETER.

This instrument was first used by Saussure, and is the most practical instrument yet devised for obtaining the moisture contents of the air. It has been very seriously criticised. For example, R. H. Scott, in his Elemetary Meteorology, p. 106, says of it: "Close to and below the freezing-point the dry and wet bulb hygrometer fails." These criticisms are largely due to the fact that observations have been tried without a proper ventilation. Experiment has repeatedly shown that with a good ventilation the psychrometer yields entirely satisfactory results and is a most important adjunct to meteorological inquiry.

## THEORY OF THE PYSCHROMETER.

The temperature of evaporation, or that given by the wet-bulb thermometer, has a certain fixed relation to the dew-point temperature, and having determined this relation, it becomes a simple matter to pass from the one to the other. Regnault proposed the following formula for expressing this relation:

$$x = f - A(t - t') p$$

in which x = the vapor tension at the dew-point temperature.

f = the vapor tension at the wet-bulb temperature, in saturated air.

A=a constant to be determined by experiment.

t=air temperature.

t'=wet-bulb temperature.

p=air pressure.

By a long series of experiments with a Regnault's hygrometer and sling psychrometer (shortly to be described) the value of A was determined as .00068. Another formula has been determined by Professor Ferrel from experiments which gives nearly identical results:

$$x = f - .000 367 p (t-t') \left(1 + \frac{t-t'}{1571}\right).$$

Experiment shows that there is no difference in the results whether the bulb be covered with water or ice. In order to make the above formula available for practical use it is necessary to prepare tables from which the necessary quantity may be taken after determining t and t'. A large number of tables have been devised for this purpose, giving the vapor tension, absolute humidity, dew-point, relative humidity, and dryness. The tables in this book are so arranged that all the above quantities may be obtained as one wishes. It has been decided to construct the table so that the dew-point and the relative humidity may be taken from it at a glance. The dew-point on many accounts is the most important element a farmer desires, and moreover, having given this, the vapor tension may be taken from the same table, and a small supplementary table will give the absolute humidity or grains of moisture per cubic foot. The so-called "dryness" of the air may also be obtained by subtracting the dew-point from the air temperature, though as this difference gives almost precisely the same result as the relative humidity both are hardly needed.

The variation of the dew-point with the air-pressure is slight up to 2,000 feet, and entirely within the errors of observation, yet if any one desires to apply this refinement it can be done by the use of the supplementary table. Instructions for the use of the tables and full illustration will be found immediately preceeding the tables. (See p. 301.)

## SELF-REGISTERING THERMOMETERS.

The use of maximum and minimum thermometers is very important, as it enables us to determine not only the highest and lowest temperature each day, but the mean of these two temperatures also gives nearly (not more than .2° to .4° above) the monthly mean temperature. The maximum thermometer, as commonly used in this country, consists of an ordinary instrument with its stem constricted near the bulb. This thermometer is placed in a position slightly inclined toward the bulb; while the constriction readily allows the mercury to pass with a rising temperature, yet it prevents all passage back to the bulb. The end of the column then indicates the highest temperature experienced during the twenty-four hours. In setting this thermometer for an observation it should be allowed to hang vertical, when a single stroke from the pin will cause the mercury to drop into the bulb. If this does not occur then the instrument must be grasped at its point of suspension and twirled rapidly. Care should be taken to see that the screw holding the thermometer upon the post is sufficiently tight to prevent the thermometer striking the board or any other projection near it.

The minimum thermometer should be hung nearly horizontal and should be set by tipping up the bulb end till the index reaches the end of the column. The end of the index nearest the end of the alcohol column is the one to be read. Care must be taken not to bring the hand near the bulbs of either the maximum or minimum thermometers in setting them. A comparison between the end of the alcohol column and the temperature of the dry-bulb should be made at the end of each month and entered on the record. The same may be done in the case of the maximum; that is, set the maximum and then compare, or else read both maximum and dry-bulb when the column is rising in both and record the comparison.

## READING INSTRUMENTS.

In reading any and all instruments, whether thermometers or barometers, it is essential to bring the eye so that the line from the eye to the end of the column shall be horizontal. This is most important in case the thermometer is graduated only on the brass scale behind the tube, as a little variation in the position of the eye above or below the line of graduation will make a large difference in the reading. A little care should be taken in the reading to note exactly the number of degrees that the thermometer indicates. It has been found that frequently errors of 5° creep in from a want of care in this respect. A little practice will enable any one to split the degree into tenths; i. e., to regard the space as divided into ten equal parts and to take the nearest tenth that the instrument indicates for record.

### THERMOMETER EXPOSURE.

Suggestions have already been given as to the proper place, in any region, where exposures should be made in order to obtain general conditions over the region. Second in importance is the question of the immediate environment of the thermometer which shall be most likely to give the true air temperature. This question has been most carefully investigated, and the following suggestions are made for the guidance of all concerned:

(1) The most important consideration is as full and free natural ventilation as is possible. This is essential even if an artificial ventilation be employed for the dry and wet bulbs. Since the maximum and minumum temperatures are necessarily unventilated, the shelter itself should give accurate results for these.

(2) Provision should be made to avoid effects of direct solar radiation, and also of heat reflected and radiated from surrounding objects.

(3) Rain should be excluded but only, as far as possible, in connection with (1). During a rain-storm the dry and wet bulbs must necessarily give the same values, the air being saturated; hence a wetting at this time is not harmful.

(4) All permanent heating effects from warm walls, chimneys, &c., should be carefully avoided.

# SLING PSYCHROMETER.

For values of dry and wet bulb temperatures the most accurate method yet devised consists in the use of dry and wet bulb thermometers fastened together and quite rapidly whirled by a string held in the hand or by means of a handle specially constructed. Any one may very readily prepare this instrument. The thermometers may be fastened back to back or side by side, the wet bulb an inch or so lower than the dry; then a rather strong wire or a good many folds of a thinner one should be passed through the hole at

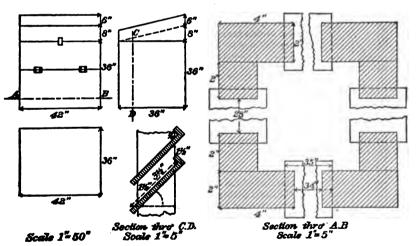
the top of the scale, and to this a stout cord about 12 inches long should be fastened. A glove finger will serve to protect the finger while whirling. The method of use is very simple. First wet the muslin by immersion and wait about a minute till the wet bulb has fallen somewhat (this is specially necessary in a very dry air, as otherwise the muslin may become dry before it has reached its lowest reading), then whirl the thermometers about 50 times, stop and read the wet bulb, then whirl 20 times and again read. If the temperature of the wet bulb has not changed it may be considered as the correct value. If there has been a change to a lower reading continue the alternate whirling and reading until the wet bulb reaches its lowest reading or one slightly higher than the one previous. The lowest reading is to be recorded. A velocity of 12 feet per second is ample.

Great care should be taken never to allow the muslin to become dry or even partly so. At night the whirling may be done at any convenient spot where there is a good ventila-The temperature should be taken at least 6 feet above sod or at any height greater If there is a wind blowing the observer should stand to the leeward; if there is no wind, in cool weather, it may be necessary to walk about while whirling in order to evercome any possible vitiation from the heat of the body. When the sun is shining, in the daytime, the temperature should be taken in the shade of a small object, high tree, or even umbrella, but not in the shade of a wall or large house. The use of this instrument when the wet bulb is covered with ice is specially satisfactory. The lowest reading at any time may be obtained in three minutes, while with a rather close window shelter, when the air is still, it will require a delay of an hour for even an approximate This instrument is exclusively used in at least one European bureau.

#### FIXED SHELTER.

For maximum and minimum readings, and for use of those observers who regard the aling too troublesome, a fixed shelter is needed. The following drawings and specifications are for a shelter adopted by the Signal Service after several years' careful experimentation with different forms.

Fig. 1. DESIGN FOR THERMOMETER SHELTER.



SPECIFICATIONS FOR THERMOMETER SHELTER.

The accompanying drawings give a general idea of the construction of the shelter, and the following description is added:

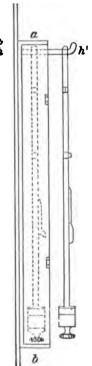
In a scenario principal property of the frame to be cubical, 3\( \frac{1}{2} \) feet long, 3 feet wide, and 3 feet high, of 2-inch pine, the corners to have 11 to 13 square inches cross-section. The top and bottom rails to be 2 by 3 inches. The bottom table close, of five-eighths-inch pine. The roof to be double, of tongue and groove boards, joints white leaded, sloping 8\( \frac{1}{2} \) inches from front to rear, with 6\( \text{ inches} \) between the roofs; the inner of five-eighths inch, the outer of seven-eighths-inch pine. The front to have a door 15\( \text{ inches} \) wide, the leagth of the side, and to open down in front. The sides to be of blind work, the slats of white pine, 3\( \frac{1}{2} \) inches wide and one-quarter inch thick, to slope at an angle of 45\( \text{ degrees to the horizontal.} \) The distance from center to center to be 1\( \frac{1}{2} \) inches. Each slat to have a strip one-half inch wide and enequarter inch thick nailed along its length on the inside, flush with the bottom. The frame to be made in four parts, and to be furnished with screws for putting together. The bottom to have one piece loose and hinged, so as to allow of dropping down, and a button to hold it up. Inside to have a frame for supporting the thermometers, consisting of two upright strips, 1 by 3\( \text{ inches fastened to long strips screwed to the right and left rails of the frame, with a strip 1 by 2\( \frac{1}{2} \) inches between those for the thermometers. The inside to have one good coat of white paint and the outside two coats. The wood to be well seasoned. The wood to be well seasoned.

It will be noted that the first consideration mentioned above is nearly fulfilled in this shelter. The rain is excluded in all cases except with high winds and mists. This shelter should be exposed upon a free grass plat where there is no obstruction to the wind, and at a height of at least 10 feet above the sod. An exposure from the roof of a building is not objectionable, provided a platform 20 feet square be first laid and the shelter be raised 8 feet above the roof. The good ventilation of a roof is specially valuable. An exposure 4 feet above sod, especially among trees or where there is very little natural ventilation, is objectionable from the fact that under such conditions radiation from the sod into space abnormally cools the sod, and that in turn cools the air above it. This effect is specially active at and a few hours after sunset. The expense of such an exposure as that just described may deter many observers from adopting it, and in such case the following substitute is suggested:

# WINDOW OR WALL SHELTER.

As its name implies this may be used from the inside of a house or it may be placed upon a wall and read from the outside; in either case the protection for the thermometers is the same and may be very easily prepared by any one. Ordinarily a wall—which should invariably be one looking due north or only a few degrees to the east or west—will give too low temperature by day, except possibly in winter, and always too high temperature by night. The reason for this is not far to seek. During the daytime a large wall does not gain the temperature of the free air but is nearly always below it, while the reverse is true at night.

These conditions are specially prominent in the case of a large brick or stone wall. The two effects above may be partly counterbalanced by the following considerations: First, the effect of the coolness of the wall by day may be offset by heat reflected and radiated



F1G. 2.

from other walls or surroundings; second, the warmth at night may be offset in like manner by radiation to the sky. This will readily suggest a form of exposure adopted by many, one very easy to manage and having the least expense of any. Select a north window, preferably of an unoccupied room, especially in winter. Fasten the blinds open at right angles to the wall of the house in order to shield from the effects of the direct solar radiation on the north side both morning and evening. Fasten a narrow strip, perhaps 3 inches wide, across the window outside and from 8 to 12 inches from the window pane; to this fasten the thermometers. Some difficulty will be experienced in setting the maximum thermometer and in wetting the wet bulb if the room is occupied, as the heated air in winter will disarrange the readings of the self-registering thermometers. This may be partially obviated by opening the upper window and conducting all operations through it. In this case the heated air rises and does not affect the readings. If there is no wind, or if the wind is south, the greatest disadvantage arising from this exposure will be the lack of ventilation of the wet bulb. This may be partly obviated by working a fan hinged near the wet bulb and operated by a handle in the room.

# PRESSURE OF THE AIR.

The Toricellian tube furnishes the means of measuring the amount of the atmospheric pressure at any moment; and this pressure may be expressed by the height of the column of mercury which it supports. Such an instrument is called a barometer. In order that its indications may be accurate, several precautions must be observed. In the first place, the kind of liquid used in different barometers must be identical, for the height of the column supported naturally depends upon the density of the liquid employed, and if this varies the observations made with different instruments will not be comparable.

The mercury employed should be chemically pure. The barometric tube is filled nearly full, and is then placed upon a sloping furnace and heated until the mercury boils. The object of this process is to expel the air and moisture which may be contained in the mercurial column, and which, without this precaution, would

gradually ascend into the vacuum above, cause a downward pressure of unknown amount, and prevent the mercury from rising to the proper height.

The next step is to fill up the tube with pure mercury, taking care not to introduce

any bubble of air. The tube is then inverted in a cistern, likewise containing pure mercury recently boiled, and is firmly fixed in a vertical position. This is a fixed barometer, and in order to ascertain the atmospheric pressure at any moment it is only necessary to measure the height of the top of the column of mercury above the surface of the mercury in the cistern. For this purpose an ivory point, the lower extremity of which is the zero of the scale, is fixed to the frame-work of the instrument, on the upper portion of which is the graduated scale and vernier. The mercury in the cistern is brought in contact with the ivory point and the vernier of the scale is adjusted to the top of the column; the reading of the scale will then give the height of the column of mercury.

Placing.—The barometer should be placed in a room of a temperature as uniform as possible, and not exposed to the sun. It must be suspended so that the top of the column will be at the height of the eye, near a window, in such a manner as to be lighted perfectly without exposure either to the direct rays of the sun or to the currents of the air which always take place at the joinings of the windows. When the barometer has to be fixed to the wall, as is the case with all the self-recording and some other barometers, care must be taken to secure the tube in a position perfectly vertical, regulating it by the plumb-line, first in the front, then at the sides, at least in two vertical planes cutting each other at right angles. When the instrument is so constructed as to take its equilibrium itself, as the Fortin barometers and those of J. Green, it is enough to hang it on a strong hook. These conditions being fulfilled, the rest of the arrangement may be varied according to the nature of the localities. For the Fortin and Green barometers the following arrangement is convenient, and may be almost everywhere

adopted. (See Fig. 2.)

A small oblong box  $(a \ b)$ , some inches longer than the barometer, and a little broader than its cistern, is firmly set against the wall  $(w \ w')$ , near the window, in such a manner as to open in a direction parallel to the panes; at the summit (a) it has a strong hook  $(h \ h')$ , which extends beyond the box about 2 or 3 inches, and on which the barometer is suspended. The instrument remains generally in the box, which is closed by a movable cover, and which protects it from external injuries, from dust, and from the direct radiation of warm bodies, or the currents of air from the window, and diminishes the effect of the too sudden variations of temperature. When it is to be observed, the barometer is taken by the upper end of the tube, and the suspending ring is made to slide towards the end of the hook. The instrument is then in the full light of the window, in front of which the observer places himself; the summit of the mercurial column, as well as the surface of the mercury in the cistern, are completely lighted, and the reading becomes easy and certain. Moreover, the slight oscillating movement impressed on the instrument, by changing its place, breaks the adherence of the mercury to the glass, and thus prepares a good observation. After the reading, the barometer is again slipped gently into the box, and this is closed.

again slipped gently into the box, and this is closed.

It has been found that even with the exercise of care the barometer cistern strikes against the box when it is pushed in, and in consequence the instrument deteriorates quite rapidly. To avoid all possibility of injury from this cause it is only necessary to make two oblong openings in the back of the box, one just at the ivory point about 3 inches long, and the other at the vernier some 8 inches long, and place in these plates of glass. If now the barometer box be suspended vertically in a north window it will be a very simple matter, to make readings by opening the box and adjusting the mercury to the ivory point, and the vernier to the top of the column, without moving the ba-

mmeter.

Observation.—Note the degree and the tenths of degrees of the thermometer attached to the instrument; for it will be seen that the heat of the observer's body soon makes it rise. Incline the instrument gently, so as to render the mercurial column very movable; then, after having restored it to rest, strike several slight blows upon the casing, in such a manner as to impress on the mercury gentle vibrations. The adherence of the mercury to the glass will thus be destroyed, and the column will take its true equilibrium. Bring, by means of the adjusting screw at the bottom, the surface of the mercury to the zero of the scale.

In the barometers with an ivory point, as the Fortin, Newman, and Green barometers, the extremity of this point is the zero of the scale, which must be brought into exact contact with the surface of the mercury. This takes place when the point coincides exactly with its image reflected below by the mercury. This method is very good when the surface of the mercury is perfectly pure and brilliant. It is generally dimmed by a slight layer of oxide, which makes the coincidence of the point with its image uncertain. It is safer to judge of the contact in a different manner. From the moment when the point does more than touch the surface, it forms around itself, by capillary action, a small depression, which, breaking the direction of the reflected rays, becomes immediately very easy to discover. It is enough, then, to raise the mercury so as slightly to

immerse the point; then to lower it gradually until the little depression disappears. If care is taken to make a good light fall on that portion of the mercury which is under the point, and to use the aid of a magnifier, the adjustment of the point thus made becomes not only easy, but very certain, and the errors to which we are liable are almost insensible, for they do not exceed two or three hundredths of a millimeter, or a thousandth of an inch.

The level being thus adjusted to the zero of the scale, proceed to observe the height of the summit of the column. Take hold of the instrument with the left hand, above the attached thermometer, without moving it from the vertical; tap it gently in the neighborhood of the top of the column; then, by means of the screw, lower the slide which carries the vernier, until the plane passing through the two lower opposite edges of it is exactly tangent to the summit of the meniscus—that is, the convexity which terminates the column. This is the case when, placing the eye exactly at the height of the summit of the column is seen without there being any trace of light between the summit and the edge of the ring. To be certain that the barometer has remained quite vertical during its operation, leave it to itself, and. when it at rest, look again to see whether the ring has remained tangential to the summit of the column. If it has not, the verticality has been disturbed; it must be adjusted anew. It is necessary, at the same time, to examine if the adjustment of the surface of the mercury in the cistern has remained the same.

Nothing more, then, remains than to read the instrument. In the English barometers the inches and tenths of inches are read directly on the scale, the hundredths and thousandths on the vernier. In the French barometers, with the metrical scale, the centimeters and millimeters are read on the scale, and the fractions of millimeters on the

### THE VERNIER.

The vernier is a contrivance for measuring fractional portions of one of the equal spaces into which a scale or, as commonly known, a limb is divided. It may seem a little difficult at first to learn to read a vernier, but careful attention to the following considerations will enable any one to read the most complicated. We will call the fixed portion of the barometer, which is divided into equal parts, the scale, and the part which moves upon it by means of the screw and ratchet, the vernier. A simple inspection will indicate the nature of the spaces or equal parts of the scale. In the common barometer these are inches and tenths, or centimeters and millimeters. Ordinarily the spaces on the whole length of the vernier are one more than on the part of the scale which it covers; i. e., if the vernier has ten spaces the scale has nine in the same length. Determine the value of the smallest space on the scale (in the common Green barometer this is one-tenth inch), divide this by the number of spaces on the vernier, and we get immediately the least count of the vernier. We have then the following rule: The least count of a vernier is equal to one of the spaces of the scale divided by the number of equal parts on the vernier.

The reading of the instrument depends on the distance from the zero point or the beginning of the scale to the zero point of the vernier. If we take a vernier and make its zero point coincide with one of the divisions on the scale we shall find the second line exactly the least count of the vernier below the second line of the scale; or, in other words, if we move the vernier until its second line coincides with the one just above the first line on the scale, just referred to, we shall move the zero just the least count above its first position. In the same way the zero of the vernier may be made to coincide with other divisions on the limb, and the distance moved will depend on the number of the line on the vernier above its zero which is coincident with the line on the scale. We have then the simple rule for reading a vernier. Read the scale up from its zero, or in the direction in which the figures on the graduations increase up to that line of the scale just below the zero of the vernier. Call this the reading of the scale. Find the number of the line on the vernier, counting the first line above the zero as i, which coincides most nearly with a line on the scale, multiply the least count of the vernier by this number, this will give the reading on the vernier; the sum of these two readings is the reading of the instrument.

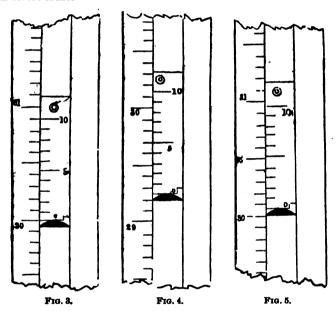
These two rules will enable any one to read the most complicated vernier though he may never have seen it before. The description takes more time than the actual reading. The observer is advised to test his ability to read the vernier by setting it at various points and then reading. After a time one reads the vernier naturally, without being obliged to follow any fixed rules. It will seldom occur that a line on the vernier exactly coincides with one on the scale, and after a little practice one will be able readily to split the least count; for example, if any two contiguous lines of the vernier lie between and exactly equidistant from two on the scale, the least count will be exactly halved. It is a very good plan, in order to avoid serious mistakes, at first to estimate the position of the zero line of the vernier on the scale, this will give the approximate value of the reading and will check the reading made from the vernier.

To read the vernier, we must look out for the line that coincides with one of the divisions of the scale. The number of this division of the vernier, proceeding from zero, indicates the number of tenths of millimeters, or of hundredths of an inch, which must be added to the whole number given by the scale. If none of the divisions of the scale coincides exactly, we estimate by the eye, in decimals, the quantity by which the vernier must be lowered to obtain a coincidence, and this is added to the fraction already obtained. This will be hundredths of millimeters in the metrical barometer, and thousandths of inches in the English barometers.

The following figures will serve as an example; the instrument is an English barometer:

In Fig. 3 the regulating line, which is the lower edge of the vernier ring, coincides exactly with the line of thirty inches on the scale. The zero and the tenth division of the vernier are also in exact coincidence; that is to say, there is no fraction. We shall read then 30.000 inches.

In Fig. 4 the regulating line does not fall upon any of the divisions of the scale, but between twenty-nine inches and two-tenths and twenty-nine inches and three-tenths of an inch. There is then a fraction which must be read on the vernier. Seeking which of these divisions coincides with that of the scale, we find that it is the fifth; we shall write then 29.250 inches.



In Fig. 5 we see that the height falls between thirty inches and thirty inches and one-tenth; no line of the vernier also coincides exactly; but the line 7 is a little above, the line 8 is a little below, one of the lines of the scale; the fraction falls, then, between seven and eight hundredths. Estimating in tenths the distance the vernier passes over between the coincidence of seven and that of eight, the tenths of a hundredth, or the thousandths are obtained. In the latter case the distance above seven is less than the half; it will read then, 30.073. It will always be easy to judge whether the top approaches nearer the upper coincidence than the lower coincidence; in the former case the fraction is greater than .005; in the latter it is smaller than .005. The error which will be committed in this estimate will remain less than .005; with practice and a little skill it will hardly ever exceed .002, always supposing the scale is well graduated. For this reading, as well as for the others, it is particularly important to have the eye exactly at the height of the line to be determined.

During the whole time of the observation of the barometer the observer must endeavor to protect it as much as possible from the heat which radiates from his body. But the best way is to learn to observe rapidly. All the operations take longer to describe than to execute; one or two minutes, if the instrument be in place, three minutes, if it is to be taken from its case and put back again, are sufficient for a practiced observer to make

a good observation.

#### STANDARD BAROMETER.

The following is a description of an improved standard barometer.

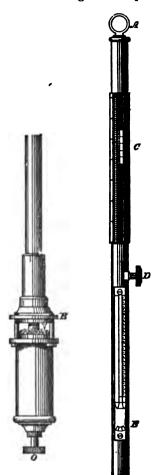


Fig. 6.

The barometer consists of a brass tube (Fig. 6) terminating at top in a ring A, for suspension, and at bottom in a flange B, to which the several parts forming the cistern are attached.

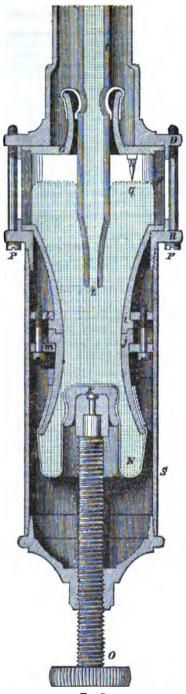
The upper part of this tube is cut through so as to expose the glass tube and mercurial column within, seen in Fig. 7. Attached at one side of this opening is a scale, graduated in inches and parts; and inside this slides a short tube C, connected to a rackwork arrangement, moved by a milled head D; this sliding tube carries a vernier in contact with the scale, which reads off to  $\frac{1}{3\sqrt{6}}$  (.002) of an inch.

In the middle of the brass tube is fixed the thermometer E, the bulb of which being externally covered, but inwardly open, and nearly in contact with the glass tube, indicates the temperature of the mercury in the barometer tube, not that of the external air. This central position of the thermometer is selected that the mean temperature of the whole column may be obtained, a matter of importance, as the temperature of the barometric column must be taken into account in every scientific application of its observed height.

The cistern (Fig. 7) is made up of a glass cylinder F, which allows the surface of the mercury q to be seen, and a top plate G, through the neck of which the barometertube t passes, and to which it is fastened by a piece of kid leather, making a strong but flexible joint. To this plate, also, is attached a small ivory point h, the extremity of which marks the commencement or zero of the scale above. The lower part, containing the mercury, in which the end of the barometer-tube t is plunged, is formed of two parts ij, held together by four screws and two divided rings l m, in the manner shown in Figure 7. To the lower piece j is fastened the flexible bag N, made of kid leather, furnished in the middle with a socket k, which rests on the end of the adjusting screw O. These parts, with the glass cylinder F, are clamped

the lower parts of the cistern, and supports at the end the adjusting screw O. G, i, j, and k, are of boxwood; the other parts of brass or German silver. The screw O serves to adjust the mercury to the ivory point, and also, by raising the bag, so as to completely fill the cistern and tube with mercury, to put the instrument in condition for transportation.

to the flange B by means of four long screws P and the ring R; on the ring R screws the cap S, which covers



F1G. 7.

## CORRECTION OF BAROMETRIC OBSERVATIONS.

Corrections must be applied to all barometer readings in order to bring the indications of different instruments into harmony with each other before they can be used for scientific purposes. Some of these corrections have reference to the special instrument, while others are applied to the reading of any instrument taken under the same conditions. The corrections of the former class are two in number:

I. Instrumental error.

II. Capillarity.

Those of the latter class are also two:

III. Temperature.

IV. Altitude above sea-level.

I. Correction for instrumental error. This is applied according to the error discovered in the individual instrument when compared with the standard. It is either additive

(+) if the barometer reads too low, or subtractive (—) if it reads too high.

II. Correction for capillarity. The indications of barometers are affected by the capillary action between the glass tube and the mercury, the effect of which is constantly to depress the mercury by a certain quantity nearly inversely proportional to the diameter of the tube.

The correction, therefore, is always additive.

This depression is greater in tubes in which the mercury has not been boiled than in those which have been subjected to this process.

All barometers of the Signal Service allow for this by depressing the scale in each

barometer just sufficient to offset the capillary action.

The certificates furnished from the Chief Signal Office for all barometers verified there give the results of direct readings of the column at different heights, and so include the corrections above mentioned, in so far as any of them are applicable to the special barometer under consideration.

Correction for t mperature, or reduction to 32° F.—All bodies are affected in their dimensions by heat; with few exceptions they expand when their temperature rises and contract when it falls, and it is therefore necessary, in taking any accurate measure of the length of any object, to know at what temperature the measure was made, in order that we may know what the length would have been at some definite temperature, which is taken as the standard temperature. In the case of barometers this standard temperature is 32°, and accordingly when the barometer is at a temperature below 32°, considering only the mercurial column, the correction is additive (+), and when it is above 32° it is subtractive (—).

If the standard temperature for the brass scale were the same as that used for mercury, the sign of this correction would change from + to - at 32°, but the temperature of the scale is regarded as 62°; hence the sign changes at 29° instead of 32°. Many European meteorologists consider the scale to be at a temperature of 32°, and in this case the sign changes at that temperature.

The temperature of the barometer is given by the attached thermometer, the bulb of which is so placed as to give as accurately as possible the true temperature of the actual

column of mercury.

The pressure is given in the table for each half inch from 24 to 31 inches, as of course the correction depends on the length of the column of which the temperature is given by the attached thermometer.

In consequence of the great risk of the heat of the observer's person affecting the thermometer attached to the instrument during the process of taking a reading of the barometer, the attached thermometer is always to be read first of all, before the reading of the barometrical column is made.

The table at the end of these instructions contains the correction to be applied to the readings of barometers mounted in *brass* frames, in order to reduce them to the normal temperature, 32°. It has been computed from the following formula given by Schumacher—

Correction = 
$$-h \frac{m(t-32)-s(t62)}{1+m(t-32)}$$

in which

h=reading of the barometer,

t=temperature of attached thermometer,

m=expansion of mercury for 1° F., taken as .0001001 of its length at 32°,

s=expansion of the substance of which the scale is made; for brass s is taken as .00001041 of its length (h) at the standard temperature for the scale, viz, 62° F.

#### CORRECTION FOR ALTITUDE OR REDUCTION TO SEA LEVEL.

As we ascend in the atmosphere the air pressure gradually diminishes. At the height of Pike's Peak, 14, 134 feet above see level, the mean pressure is about 17.8 inches, at sea level it being 30.0 inches. In order then to make barometer readings comparable at different stations it is necessary to reduce them to a common plane. This has been assumed at sea level. This reduction depends upon the temperature of the outside air as well as the height of the station. It is important that each observer obtain as accurately as possible the elevation of his barometer, first, above a fixed point near its place of suspension; second, the elevation of the above fixed point above some plane, such as a railroad track at station, bench-mark on canal, level of the great lakes, or zero of river gauge; and, third, the elevation of such plane above sea level. If it is found impossible to get the correct elevation in this way, an approximate value may be computed by means of barometric observations at the station compared with those made at the same time at a neighboring station the elevation of which is already known. As a general thing, however, it will be found feasible to obtain the elevation will give the reduction for barometer readings at stations up to 1,500 feet; for greater heights a special table will be needed. This may be computed from the following formula:

$$\operatorname{Log}_{\overline{h'}}^{h} = f \div \left\{ 60159 \left( 1 + \frac{t + t' - 64^{\circ}}{900} \right) \left( 1 + 00268 \cos 2 \ l \right) \left( 1 + \frac{f + 52251}{20886861} \right) \right\}$$

From a table of common logarithms, the natural number corresponding to  $\log \frac{h}{h'}$  is found; or  $\frac{h}{h'} = n$ , and h = n h'.

In this formula-

h and h'=barometer reduced to 32° F., at the lower and upper stations respectively.

t and t'=the temperature of the air at the respective stations,

f=elevation of upper station in feet,

i=latitude of the place.

# SUBSTITUTES FOR MERCURIAL BAROMETERS.

Aneroids and metallic barometers are useful substitutes for the mercurial barometer. The aneroid is an instrument which has come into extensive use, owing to its convenient size and portability. These recommendations have at once secured its very general adoption.

In the aneroid, atmospherical pressure is measured by its effect in altering the shape of a small, hermetically sealed, metallic box, from which almost all the air has been withdrawn, and which is kept from collapsing by a spring. The top of the box is cor-

rugated.

When the atmospherical pressure rises above the amount which was recorded when the instrument was made, the top is forced inwards, and *vice versa*, when pressure falls below that amount, the top is pulled outwards by the spring. These motions are transferred by a system of levers and springs to a hand which moves on a dial like that of a wheel barometer.

The instrument must be graduated experimentally, as it cannot measure pressure absolutely, but affords indications relatively to a mercurial barometer (its sensibility de-

pending inter alia on the quality of the metal of which the box is made).

The principle of the metallic (Bourdon's) barometer is somewhat similar to that of

the aneroid.

Aneroids are very sensitive, but unfortunately they do not preserve their accuracy. If a table of corrections be determined for an aneroid, it will be found that after a time it has undergone some change, and that the values of the corrections will require alteration, so that recomparison with a standard barometer will be necessary. In every case of such comparison the readings of the mercurial barometer should be reduced to 32°,

and standard gravity at latitude 45°.

A most serious objection to the scientific utility of these instruments is their liability to injury, owing to rust or to the alteration of force in the springs used in their construction. However, for the reasons above stated, the aneroid is especially suitable for fishermen, pilots, or sea-faring persons employed in boats or small coasting vessels, in which there is not space to suspend a barometer; and, of course, all that is stated regarding the harometer as a weather indicator, applies to the aneroid so far as a single observer is concerned. For concerted observations accurate mercurial barometers are indispensable.

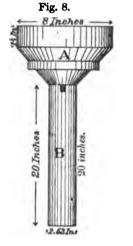
#### PRECIPITATION.

A knowledge of the rain and snow fall of any locality is of great importance to the farmer. and each one should have a rain-gauge. By its use the gardener will be guided in determining the amount of moisture needed by his plants. The health and increase of domestic animals, the value of the crops, as well as the labors of the farmer, are dependent on the excess or deficiency of rain. Statistics of rainfall are very frequently called for in connection with crop production, sanitary arrangements in any town, and engineer operations, especially in the line of water supply. The hydraulic engineer must determine the rainfall in order to provide against floods in rivers and droughts on land. The observation of rain is one of the simplest imaginable, though one of the most difficult to make an estimate on. Some observers have sent in an estimate of 10 inches in a single storm: this is impossible except in very rare cases of cloud bursts. No estimates of rainfall should ever be recorded, but if an observer has no means of measuring rain, the record should be light (lt.), heavy (hy.), or very heavy (v. hy.). If one has no regular gauge, a pail with nearly vertical sides, a tub, or a simple tomato can should be used. An ordinary foot-rule or a yard-stick will measure the depth of rain after it has been caught. The following is a description of the rain-gauge used by the Signal Service. In the latest pattern adopted the edge of the receiver is very carefully turned from brass and the cylindrical reservoir is of drawn brass tubing, which makes the gauge very accurate.

## BAIN-GAUGE.

The rain-gauge adopted for Signal Service stations consists of a funnel-shaped receiver, surmounted by a cylinder 11 inches in length and 8 inches in diameter. The funnel is placed in a cylindrical reservoir 2.53 inches in diameter and 20 inches in height. area of the cross-section of the reservoir is to that of the receiver as one to ten, or 1 inch of rain falling in the receiver corresponds with 10 inches of water in the gauge. The amount of rainfall collected in the gauge is measured by means of a graduated rod on which are marked inches and tenths of inches; 1 inch (10 spaces) on the rod corresponds to 0.1 (0.10) of an inch of rain, and 0.1 of an inch (1 space) on the rod to 0.01 of an inch of rain. To provide for very heavy rainfalls the guage is placed within an outer galvanized iron cylinder 6 inches in diameter and 231 inches in height, and an opening is made The gauge will in the top of the small cylinder of the gauge at the height of 20 inches. then receive 2 inches (200 spaces, or 20 lineal inches on the rod) of rainfall, and when more than this falls the excess will flow over into the attached cylinder. To ascertain the amount of rain when it is in excess of 2 inches, first note the 2 inches in the small cylinder, then empty it, and pour into it the water in the outer cylinder; measure the amount, as already directed, add it to the 2 inches poured from the small cylinder, and the sum will be the total amount of rainfall.

# SIGNAL SERVICE RAIN-GAUGE.





# DESCRIPTION.

- A. Funnel-shaped receiver, area 50.30 inches.
   B. Receiving reservoir, area 5.03 inches.
   C. Overflow attachment.

In measuring the rainfall, as the inside reservoir has one-tenth the area of the receiver, the number of inches of water should be counted as tenths. Sometimes the measuring stick becomes slightly oily and in consequence the line of water will not be clearly marked; in such case draw the stick through the hand once or twice, and when again dipped in the water there will be found a very clear and well defined line of demarkation.

In many cases observers have had a gauge, similar to the above in size and shape, made from tin by a tinsmith, and afterward painted. Care should be taken in exposing the gauge to have it only 1 to 2 feet above a level plane, and at least the distance of

twice the height of an object from it.

SNOW.

In measuring snow the best way in many cases is to take the outside overflow attachment and press it, mouth down, into new-fallen snow where it has not drifted, then by passing a thin shingle at the bottom of the snow a cylinder of it, the size of the overflow, may be taken up, melted, and measured as melted snow. In melting snow, the best way is to press the bottom of the gauge into a pail of rather hot water, and keeping it there till the snow has entirely melted. Care should be taken in all cases to epter the amount of snow unmelted in its appropriate column. The above method of obtaining melted snow is quite tedious, and the following will do nearly as well and even better if there is much drifting: Select a level plane of some extent and carefully measure the depth of freshly-fallen snow in at least three places where it has not drifted. If the three measurements nearly agree their mean will give the snowfall, and one-eleventh or one-tenth, according as the snow is light or heavy, will give an approximate value for the melted snow. If snow heavier than 10 inches to the inch of water falls it can almost invariably be measured in the rain-gauge as it must be almost melting, or at least not easily blown out of the gauge.

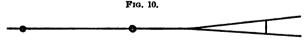
Most difficulty will be experienced in noting precipitation when rain changes to snow or rice versa. In the first case care should be taken to measure the rain and snow in the gauge as soon as it is found that the snow is being blown out or has filled the receiver, and after that only the snow should be measured, being careful not to measure any of the snow twice. The same precautions are needed when the reverse takes place, namely, snow turning to rain. This is a very difficult matter to give rigid rules upon, and each observer must depend largely upon his judgment in each individual case. The fall of rain or snow should be measured at the end of the storm, and a careful note of time should be made of the beginning and ending of the rain. In many cases it would be very interesting to have the time of beginning and ending of the heaviest rain.

APPARATUS EMPLOYED FOR REGISTERING THE DIRECTION, PRESSURE, AND VELOC-ITY OF THE WIND.

The vane.—The instrument by which the wind's direction is most generally noted is the vane, or weather-cock, and all that need be said of it here is that the points north, east, south, and west, usually attached to it, should indicate the true and not the magnetic directions, and that care should be taken to prevent its setting fast. Very complicated instruments are required for ascertaining the pressure and velocity of the wind, and these are called anemometers.

Placing.—The wind-vane should be set in a place as free and open as possible, away from every obstacle, and especially from high buildings. It should exceed in elevation by at least 8 or 10 feet the neighboring objects.

As a flat vane is always in a neutral line, an accurate and sensitive one is made by fastening two plates together at an angle of about 10 degrees, forming a long wedge. Thus,



The longer the vane the shorter the pulsations, and the steadier the action will be. A

small-sized vane may be 10 or 12 inches wide and 4 feet long. Observation.—The observation of this instrument demands some care. In winds of

considerable strength the vane is never at rest or fixed in the same direction; it oscillates incessantly, and its oscillations increase in amplitude with certain winds, and with the violence of the wind. We must then note the mean direction between the extremes. When the wind is very feeble perhaps it may not have sufficient force to set the vane in motion; in this case, as when the air is calm, great mistakes might be made by registering the direction marked by the index, for its position indicates not the direction of the existing wind but that of the last wind that had the power to set the instrument in mo-When the index is immovable and there is no oscillation we must give up its indications and refer to the movement of light bodies, as that of the leaves of trees and the smoke of chimneys, to determine the direction of these feeble currents of air. During the night the direction of the wind may be easily ascertained by raising the hand in the air with one finger wet. The least motion in the air increases evaporation, and a sensation of cold is experienced on the side of the finger turned towards the wind.

The direction of the wind must be noted, following the eight principal points of the compass—north, northeast, east, southeast, south, southwest, west, and northwest.

The lower or surface wind often has a different direction from that which prevails in the upper regions of the atmosphere, and this is generally the case when the wind turns and the weather is going to change, also during storms and great atmospheric move-

The manner in which the wind turns, or rather the order in which the winds succeed one another in the course of the day, must be watched very carefully. It will be seen that they commonly follow in regular order; they pass from the east by the south to the west, and from the west by the north to the east. Nevertheless, they sometimes go back in the opposite direction, particularly during storms. A little memorandum, summing up in a few words at the end of each day this course of the wind, together with the hours of the wind's changes, is very valuable. It may be entered in the column of remarks.

The general appearance of the vane in use in the Signal Service and the location of

the several parts are shown in Fig. 10. The iron straps which unite the two parts of the foot-block must be taken off and the block separated before raising the vane, in order to put the iron socket holding it in proper position. After the vane is up the pieces must

be fastened firmly together again by these straps.

## VELOCITY OF THE WIND.

The instrument generally used for determining the velocity of the wind is Robinson's anemometer, which consists of four hollow hemispherical cups mounted upon arms at right angles to each other, with the planes of their faces vertical and facing the same way around the circumference. These are placed upon a vertical axis, which has at its lower extremity an endless screw. The axis is supported so as to turn with as little friction as The endless screw is placed in gear with a wheel which moves the two dials, which register the number of revolutions of the cups.

It has been proven, both by theory and experiment, that the center of any one of the cups so mounted and set in motion by the wind revolves with one-third of the wind's velocity. If, therefore, the diametrical distance between the centers of the cups be 1 foot, the circle described by the centers in one revolution is 3.1416 feet, and the velocity of the wind will be three times this, or 9.42 feet, which must be referred to time for the absolute rate. The instrument is sometimes made with the center of the cups 1.12 feet apart, so that the circle described is 1500 of a mile in circumference. Hence, to produce one revolution of the cups, the wind must travel three times as fast, or 500 of a

mile. Therefore, 500 revolutions will be produced by one mile of wind.

The pattern of anemometer used in the Signal Service has the registering dials mounted concentrically. The outer dial has one hundred and the inner dial ninety-nine divisions. As the dials are moved by the the same wheel, they will move forward one hundred divisions in the same time (Fig. 11). The outer dial having one hundred divisions, the inner dial will complete one revolution and its zero be one division beyond or to the left of the zero of the outer dial when the outer dial has completed one revolution, the zeros of the scales coinciding at the time the instrument was set in motion. Thus the revolutions made by the outer dial are recorded on the inner one, the number of revolutions being shown by the number of divisions of the scale on the inner dial between the zero of that scale and the zero of the outer one. In taking the reading of the anemometer at any time the hundreds and tens of miles are read from the inner scale, and the miles and tenths of miles are read from the outer one. Take from the inner scale the hundreds and tens of miles contained between the zero of that scale and the zero of the outer one, and the miles and tenths of miles on the outer scale contained between the zero of that scale and the index of the instrument, and the sum of these readings will be the reading of the instrument at the time of making the observation.

When the anemometer is not furnished with an index-point the center of the small wheel which gives motion to the dials will be taken as the reference point.

The total movement for the twenty-four hours will be obtained in the following manner: Subtract the reading of the anemometer at 12 noon of the preceding day from the reading taken at 12 noon of the current day, and the difference will be the total movement of the wind. When the reading of the anemometer is less than the reading of the preceding day, 990 miles will be added to it, and the remainder, after subtracting the reading of the preceding day, will be the total movement.

Example: The dial reading of to-day is 91, and that of yesterday was 950, hence we have 91+990=1081; 1081-950=131, the total movement of the wind in miles during

the past twenty-four hours.

Anemometers must be kept carefully and thoroughly oiled to prevent friction and injury to the several bearings. Especial attention must be given to the large dial-screw, and when found loosened it must at once be tightened, but care must be taken not to

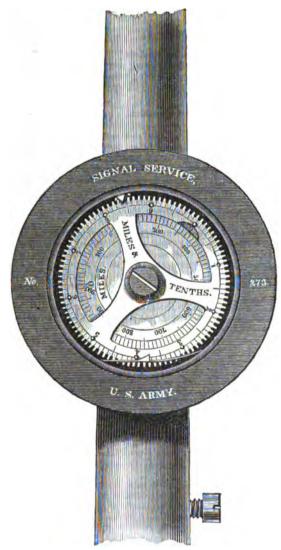


Fig. 11.—Anemometer dial.

screw it up tight enough to interfere with the free motion of the dials. Other instruments are in use which determine the force of the wind by measuring the pressure exerted upon a given surface.

The Vienna Congress has recommended the introduction of Professor Wild's pressure gange, which is in use in Russia and Switzerland. This consists of a rectangular plate hung on hinges on a horizontal axis. The angle which this makes with the vertical indicates the force of the wind.

The pressure of the wind has been experimentally proved to vary as the square of the velocity, the relation being  $P=.003\ V^2$ . From this formula, therefore, the pressure can be calculated corresponding to the observed velocity.

The forms furnished voluntary observers have upon them a designation of the force of the wind on a scale of 0 to 10, but many have found it very difficult to use such a scale, and to such the following may commend itself; it is the scale largely used in Europe and is quite easy of application. In all cases where the observer uses this scale he should carefully write 0—6 in place of 0—10 on the form.

0. Calm.

1. Light; just moving the leaves of trees.

2. Moderate; moving branches.

3. Brisk; swaying branches, blowing up dust.

4. High; blowing up twigs from the ground, swaying whole trees.5. Gale; breaking small branches, loosening bricks on chimneys.

6. Hurricane or tornado; destroying everything in its path.

#### CLOUDS

The study of the forms and movements of clouds is of great importance in meteorology, for they afford the only means of knowing what changes are in progress in any part of the atmosphere above the lowest stratum. The very existence of a cloud, at any elevation, shows that the atmosphere is there in a state of saturation, and the lower the cloud the more humid is the atmosphere. The forms of the clouds may give information as to the changes of temperature and the cause of these changes, and their movements show what winds are blowing high up in the atmosphere and even the rate of their movement. If the height of the clouds is measured they serve as an accurate wind-vane and anemometer.

Cloud observations include their quantity, form, and movement.

Cloud proportion.—The proportion of the sky covered by clouds may be determined by simple inspection. A sky wholly overcast is recorded as 10, and all minor degrees of cloudiness by the lower numbers, 0 being used to indicate less than one-twentieth of cloudiness. Of course, only an approximate estimate is possible, but with a little practice this may be made sufficiently accurate for practical requirements. It may assist beginners in making this estimate, to notice that if the sky be divided into five triangular segments by five equidistant lines drawn from the zenith to the horizon, each of these will be divided into two nearly equal parts by a line parallel with the horizon, and at one-third the distance between it and the zenith.

## CLASSIFICATION OF CLOUDS.

The most important are the three primary forms, cirrus, cumulus, and stratus, and the combinations cirro-cumulus, cirro-stratus, cumulo-stratus, and nimbus.

Cirrus.—Clouds composed of loose, parallel or divergent fibers, looking like hair or feathers, but varying greatly in form. It is a very lofty cloud, sometimes attaining the height of 10 miles. It is usually of very small density, and is probably composed of minute snow crystals, because the phenomena of halos are produced by them which can only be explained by the refraction of the rays of light through ice crystals. The motions of the cirrus often differ in direction from those of the surface-winds, showing the general movements of the upper strata of the atmosphere, and are often indicative of coming changes.

Camulus.—Convex or conical heaps increasing upwards from a horizontal base. These are dense in structure and of a round or globular form, and are often called "cotton-bale." They are formed in the lower atmosphere and move with the current close to the earth. They are formed by ascending currents of warm air rising from the heated ground until, becoming cooled below the dew-point, it condenses into visible cloud. The rounded top results from the fact that an ascending current is stronger near its center than at its external parts and carries up the vapor to a greater height. In fair weather the cumulus often form a few hours after sunrise, go on increasing until the hottest part of the day, and generally disappear about sunset, though they may continue through the night. They sometimes take the form of rolls.

Stratus.—A widely-extended continuous horizontal sheet, increasing from below upward. This is generally a fine-weather cloud, appearing at night and morning of the brightest days. It is a layer or horizontal sheet of uniform thickness, appearing at a distance like a streak on the horizon. It generally forms about sunset, grows denser during the night, and vanishes at sunrise. It is caused by the vapors which have risen during the day, and which, as the ascending currents become weaker toward evening. approach the earth. As the cooling of the air during the night begins near the ground, and thence proceeds upward, the condensation of the vapor first appears near the ground.

and thence increases from below upward as the successive layers of air become cooled below the dew-point. Descending smoke and dust contribute to the density of stratus clouds.

Cirro-cumulus.—Small, well-defined roundish masses in close horizontal arrangement or contact. This is also a high cloud, though usually at a lower level than the cirrus, from which it differs in being more globular in form as it consists generally of small detached rounded masses, like a flock of sheep lying down. When at a low level it may be difficult to distinguish these clouds from small cumuli. It occurs very frequently in summer, particularly in dry and warm weather.

Cirro-stratus consists of delicate fibrous clouds spread out in strata, which are either horizontal or but slightly inclined to the horizon. This cloud appears to result from the subsidence of the fibers of the cirrus to a lower level. Sometimes the whole sky is so mottled with this cloud as to resemble the back of a mackerel-"mackerel sky." The cirro-stratus precedes wind and rain, and is almost always to be seen in the intervals of storms. It should be noted that the term "mackerel sky" is applied to the cirro-cumulus in England and other countries, and there indicates fine weather, but in the United States it is regarded a foul-weather cloud.

Cumulo-stratus.—This has for its base a horizontal layer or stratum from which rise large overhanging masses of cumulus. It is the cumulus changing into the nimbus.

Nimbus.—A cloud from which rain is falling. It is generally composed of different clouds which are so blended that it becomes impossible to distinguish them.

The term "Scud" indicates loose, detached clouds drifting rapidly before the wind.

#### CLOUD MOVEMENT.

The great difficulty in getting at the true direction of cloud movement lies in the effect

of perspective. The following device eliminates this:

Set up a pointed pole, reaching 6 or 8 feet above the observer's head, and through the top, an inch or so below the point, fix two stout cross-wires, or thin iron rods, set truly by compass to the four cardinal points. The space around the pole must be sufficiently open to allow of a good view of the sky in all directions. Let the observer then station himself at such a distance from the pole, and in such a position that some recognizable limb of a cloud appears to move vertically upward from the top of the pole or vertically downwards toward it. The direction of the pole from the observer's position (which may be judged of accurately by means of the cross-wires on the top) is the direction of the cloud's true movement. With a little care in selecting the position the pole may be dispensed with, as any pointed object will serve the purpose, provided the observer has previously acquainted himself accurately with the points of the compass. The velocity of cloud movement may be measured in favorable situations by observing the time that the shadow takes to traverse a certain space of country, the extent of which is accurately known."

The direction from which the clouds are moving should be recorded to 8 points N. NE., E., &c. The velocity may be recorded by the letters s slowly and r rapidly placed as an exponent to the direction thus, Nr, S'.

Haze, smoke, and fog should be recorded as such, with the addition of the words

"light" or "dense," as the case may be.

# STATE OF THE WEATHER.

Clear, when the sky is  $\frac{3}{10}$  or less obscured; fair, when the sky is from  $\frac{7}{10}$  to  $\frac{7}{10}$ obscured; cloudy, when the sky is more than  $r_0$  obscured; light rain (lt. r.), when there is light rain; heavy rain (hy. r.), when there is heavy rain; in like manner with light and heavy snow, substituting s for r; fog, haze, smoke, according as these are predominant.

Occurrence of first and last frost of any growing season should be specially noted as well as all killing frosts during the same.

# CORONÆ.

These must be distinguished from halos. Coronæ are very common, specially around the moon, and are produced by the rays passing through a thin layer of cloud. Sometimes as many as three small concentric circles may be seen whose diameters are in the ratio of 1:2:3. They are frequently colored, red being the outside color. These colors are not the pure colors of the spectrum, but rather those of the opal, and are caused by interference and not refraction. A solar corona is not often visible on account of the dazzling brightness of the sun, but it may often be seen by viewing the sun through colored glass, or noticing the reflection in the water.

Halos are large circles of 45° or 92° in diameter. That is, the diameter is equal to one-eighth or one-fourth the circumference of the horizon. Both are seldom seen at the same time. The colors are very feeble, generally approaching whiteness. Halos arise from the presence in the atmosphere of minute prisms of ice and consist of refracted light. Sometimes the halo is intensified into two bright spots, one on each side of the central luminary. These are called "parhelia" or "paraselenes" (mock suns or mock moons). Still more complicated phenomena are sometimes seen, through rarely, except in high latitudes.

#### THUNDER-STORMS.

Thunder-storms six hours apart may be taken as separate storms.

Upon the occurrence of thunder, give as nearly as possible the time of first, loudest, and duration of thunder (being careful to note a. m. or p. m. if the hours 0 to 24 are not used). Frequently when a storm has passed there will be muttering of thunder, but a little observation will show when a storm has really passed.

Give the direction from which the storm appears to be coming, as shown by threaten-

ing sky, lightning flashes, or thunder peals. Also, the direction toward which it goes. It is proposed to attempt the use of a scale to indicate the approximate intensity of the storm. This is confessedly a very difficult matter to decide upon, but it is much needed in order to have a means of comparison of storms in future, and the following is suggested for trial:

1. Distant lightning (the number is not needed in this case).

2. Distant thunder.

3. Moderate thunder-storm.

Heavy thunder-storm.
 Heavy thunder, with very high wind breaking small branches off trees, &c.
 Thunder with hurricane or tornado.

#### TORNADOES AND LAND-SPOUTS.

These whirlwinds, or violent and circumscribed storms, give rise to very complex phenomena, which are difficult to observe. All the meteorological circumstances, however,

should be minutely noted; among others the following:

The course of the barometer, which almost always sinks much and rapidly; that of the thermometer, which usually indicates an elevation of temperature; the region of the heavens in which the thunder-storm frequently accompanying them is formed; the form and color of the clouds; the direction and intensity of the wind; the frequency, size, and form of the lightning; finally, the apparent shape of the land-spout, its variations, its course, and its effects upon the trees and upon the ground.

#### ADDITIONAL OBSERVATIONS DURING STORMS.

Everybody knows the importance of a knowledge of the laws of those great movements of the atmosphere which embrace almost the whole extent of the continent. It is only in following them, step by step; by observing their different phases at different places, and by combining the facts obtained, that the meteorologist can be enabled to discover the laws which preside over these great phenomena. For this the three regular observations a day are insufficient; it is then earnestly recommended to observers, who desire to contribute effectually to the solution of this great problem, not to content themselves with the prescribed number, but to add as many more as possible during the continuance of remarkable storms; noting not only the state of the instruments from hour to hour, if possible, but following with attention all the meteorological changes. These observations must be entered on the reverse of the sheet, under the head of Casual Phenomena," which is particularly reserved for this purpose.

The principal points to which attention should be directed are the following:

The barometer announces, by a considerable fall, the approach of a storm. Then it begins to rise during its continuance, and only resumes its normal equilibrium after its close. Note especially the following points:

Was the storm preceded by a noticeable or sudden rise previous to the fall;

Note the state of the barometer, and the time when the fall becomes more rapid;

Its state, and the time, when it is lowest and when the rise begins;

The highest point which it reaches during or immediately after the storm.

If alternations of rising and falling take place, the fact should be mentioned and the

The thermometer.—The fluctuations of the thermometer in the same time as those of the barometer should also be noted, and their connection with the changes of the wind be observed.

The wind.—It is of the greatest importance to observe the course of the winds through the entire height of the atmosphere during the whole continuance of the storm, by means of the wind-vane and of the clouds in the different layers of the atmosphere.

The hour when the wind begins, and the direction whence it comes;

The moment of its greatest violence;

The instant it changes its direction, and when it takes the direction it keeps to the end of the storm.

It should be stated if the wind blows in a continuous manner or in squalls, and what is its force.

If there should be one or more moments of calm, the hour and duration will be indicated.

Great care must be taken at each observation to note also the direction of the different layers of clouds, which will very often be found different from that of the wind below, for the whole duration of the storm.

The clouds.—Are there certain forms of clouds which announce the approach of a storm? It is necessary, in this connection, to watch the formation of the cirrus, the cirro-cumulus, cirro-stratus, their arrangement in parallel lines, their course, and their direction. Note the quarter of the sky first covered with clouds; the moment when it is entirely covered; if there are later clear spots or not; the moment when the sky clears off.

The rain.—Note the hour at which the rain or the snow begins and ends; measure the quantity fallen while the storm lasts.

#### INSTRUCTIONS FOR OBSERVING AURORAS.

Though the aurora borealis has received attention during a considerable portion of the last two centuries, definite information is still wanting on several points which may serve as the basis of a sound induction as to its cause. These relate particularly to the actual frequency of its appearance; its comparative frequency in the different months of the year and different hours of the day; the connection of its appearance with other atmospherical phenomena; the elevation and extent of visibility of the arch; and whether the same or different phases are presented to individuals at different stations at the same moment of time; finally the precise influence of the arches, streamers, &c., on the magnetic condition of the earth; and whether any unusual electrical effects can be observed during the appearance of the meteor.

Auroral phenomena may be divided into the following classes:

1. A faint light in the north, without definite form or boundary.

2. A diffused light, defined by an arch below.

- 2. Floating patches of luminous haze—sometimes striated.
- 4. One or more arches, resembling the rainbow, of uniform white color, retaining the same apparent position for a considerable time, and varying in luminosity.

5. A dark segment, appearing under the arch.

- 6. Beams, rays, streamers, waves, transverse and serpentine bands, interrupted or checkered arches, frequently tinged with color, and showing rapid changes in form, place, and color.
  - 7. Auroral corons, or a union of beams south of the zenith.

8. Dark clouds accompanying the diffuse light.

9. Sudden appearance of haze over the whole face of the sky.

The following may serve as a scale of brightness: (1) Faint; (2) Moderate; (3) Bright; (4) Very bright.

#### GENERAL DIRECTIONS.

- 1. Make a regular practice of looking for auroras every clear evening, from 8 to 10 o'clock or later. Record the result, whether there be an aurora or not.
- 2. Note the time of observation, and compare the watch used with a good clock, as soon after as is convenient.
  - 3. Make a return of the latitude and longitude of the station.

4. Note the class to which the auroral phenomenon belongs.

- 4. If it be an arch, note the time when the convex side reaches any remarkable stars, when it passes the zenith, disappears, &c.
- 6. If the arch be stationary for a time, note its position among the stars, so that its altitude may be determined.
- 7. If it be a streamer or beam, note its position, and the time of its beginning and ending.
- 8. If motion be observed in the beams, note the direction, whether vertically or horizoutally, to the east or west.

9. Note the time of the formation of a corona, and its position among the stars.

- 10. Note the time of the appearance of any black clouds in the north near the aurora; also, if the sky be suddenly overcast with a mist at any time during the auroral display.
  - 11. Give the direction and force of the wind at the time.

12. Note if any electrical effects are observed.

13. Note the effect upon a delicately-suspended magnetic needle.

14. The date, hour, and minute of the beginning and ending of auroras should be carefully noted, as well as the azimuth and altitude of each extremity and of the crown of any arch of light, and the same data for any corona or glory that may be formed.

When the observer is familiar with the names of the principal fixed stars, he may locate the arch or crown by reference to them, but it is preferable that he should observe directly the altitude and azimuth.

Altitudes are expressed by degrees from the horizon to the zenith.

If any circle be divided into three hundred and sixty parts, and the radial lines connect these parts with the center, each pair of lines subtend an angle of one degree; the fourth part of the circle will subtend to an angle of ninety degrees or one right angle, and the corresponding radii are perpendicular to each other; thus the zenith (that point of the heavens immediately above the observer) is ninety degrees from the horizon, or, in other words, its altitude is 90°. A point half way up from the horizon to the zenith has an altitude of 45°.

Azimuths are also expressed in degrees, but are measured on the horizontal plane, and will be recorded as is done in astronomy, from the south point to the westward, passing, successively, the west, north, and east points of the compass until 360° have been

passed over, and the south point is again reached.

Observers should be particular as to the date of the aurora; and when it begins in the evening of one day and continues into the early morning of the next day, it will be entered as occurring on the first day, but its details will be given in the record as occurring between the hours of its actual beginning and ending. Thus, an aurora that began on the evening of the 12th of January and continued until the early morning of the 13th would be entered as the aurora of the 12th, but its details would be recorded as occurring, for instance, between the hours of 10 p. m. of January 12 and 2 a. m. of January 13.

Professor Olmstead, in a paper published by the Smithsonian Institution, classifies

different auroras as follows:

"Class I.—This is characterized by the presence of at least three out of four of the most magnificent varieties of form, namely, arches, streamers, corona, and waves. The distinct formation of the corona is the most important characteristic of this class; yet, were the corona distinctly formed, without auroral arches or waves, or crimson vapor, it could not be considered as an aurora of the first class.

"Class II.—The combination of two or more of the leading characteristics of the first class, but wanting in others, would serve to mark class the second. Thus the exhibition of arches and streamers, both of superior brilliancy, with a corona, while the waves and crimson columns were wanting, or of streamers with a corona, or of arches without a corona, without streamers or columns (if such a case ever occurs), we should designate as an aurora of the second class.

"Class III.—The presence of only one of the more rare characteristics, either streamers or an arch, or irregular coruscations, but without the formation of a corona, and with

but a moderate degree of intensity, would denote an aurora of the third class.

"Class IV.—In this class we place the most ordinary forms of the aurora, as a mere northern twilight, or a few streamers, with none of the characteristics that mark the grander exhibitions of the phenomenon."

The same author remarks:

On the evening of the 27th of August, 1827, after a long absence of any striking exhibition of the aurora borealis, there commenced a series of these meteors, which increased in frequency and magnificence for the ten following years, arrived at a maximum during the years 1835, 1836, and 1837, and, after that period, regularly declined in number and intensity until November, 1848, when the series appeared to come to a close. The recurrence, however, of three very remarkable exhibitions in September, 1851, and of another of the first class as late as February 19, 1852, indicates that the close was not so abrupt as was at first supposed; but still there was a very marked decline in the number of great auroras after 1848, and there has been scarcely one of the higher class since 1853.

#### EARTHQUAKES.

The Chief Signal Officer is desirous of collecting information in reference to all phenomena having a bearing on the physical geography of this continent; and it is requested that observers will furnish any information which they may possess, or be able to obtain, in regard to earthquakes occurring in their neighborhood.

It will be interesting to determine the geographical limits of the disturbance, and to ascertain whether it was confined to any particular geological formation. If the direction

of the shock was observed at a few places, the center of commotion could be determined; and if the time were accurately known at different points, the velocity of the earth-wave could be calculated. Hence, an answer is requested to the following questions, viz.:

Was the agitation felt by yourself, or by any other person in your vicinity?
 What was the approximate time of the occurrence?

3. What was the number and duration of the shocks?

4. What was the direction of the motion?

- 5. What was the character of the disturbance; was it vertical, horizontal, or oblique; was it an actual oscillation; an upheaval and depression, or a mere tremor?
  - 6. Was there any noise heard; and if so, what was its character?
- 7. Was the place of observation on soft ground, or on a hard foundation near the underlying rocks of the district?
  8. Were any facts observed having apparently an immediate or remote bearing on this

phenomenon?

9. What was the intensity of the force in reference to producing motion in bodies and cracks in walls?

Note.—Please reply to the first question, if to no other; for an answer to it is neces-

sary, in order to determine the limits of the commotion.

The direction of the impulse may have been ascertained by observing the direction in which molasses, or any viscid liquid, was thrown up against the side of a bowl. The remains of the liquid on the side of a vessel would indicate the direction some time after the shock occurred.

#### GENERAL PHENOMENA OF CLIMATE.

Phenomena of a general character, of which the date of appearance cannot be mistaken, are very valuable. Series of years have in some cases been carefully observed, which would greatly add to the value of the current record, if forwarded with it. The following are of this class:

1. Breaking up of ice in large rivers or bays.

2. Date of greatest rise and lowest fall of water in large rivers, especially when periodic, as in parts of the interior.

3. General leafing and fall of leaf in decidious forests. In most parts of the North

and the interior, these are well marked and easily designated periods.

4. Beginning of growth and the end of growth or destruction of grasses in general, as on plains or prairies.

5. First growth, flowering, and maturity of important annual staples, with their period in days from the beginning to the end of vital action.

Voluntary observers are requested to include in their monthly reports all reliable information relative to the destruction of life and property coming to their knowledge, classifying it, as far as possible, as indicated in the following table:

Date of storms.	Nature of storms (tornado, northeast gale, &c.).	Section of country traversed by storm.	Number and names of persons killed.	Number and names of persons injured.	Number and names of vessels lost or damaged, with estimated amount of loss.	Number of houses, barns, and other build- ings destroyed or dam- aged, with estimated amount of loss.	Estimated amount of damage to property.	Number of an imals killed, and estimated value.
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#### SPECIAL DIRECTIONS TO THE VOLUNTARY OBSERVERS OF THE SIGNAL SERVICE.

In the reduction of the meteorological records presented to this office, much additional labor has resulted from the occasional omission in the records of some important facts. and in a want of perfect uniformity in noting the phenomena. To insure uniformity in the records attention is called to the following remarks:

1. Failure to record latitude and longitude, name and station of the observer, and date on cach sheet; the observer probably supposing it sufficient to insert them once on the first sheet sent, and so omitting them afterwards. This often renders it necessary to search back through all the series of registers to some one that contained them—perhaps in a

former year. They should be inserted on every sheet.

- 2. Designating the same place by different names, thus rendering it impossible to distinguish whether it was one place or two, unless by accidentally noticing the similarity in the name of the observer or in the latitude and longitude. Such changes of name should be avoided when practicable; and when necessarily made, special attention should be called to it.
  - 3. Diversity in the mode of recording the barometer, as follows:

(a) Integers record in full, thus 29.35. (This is the proper mode.)

(b) Integers omitted when the same as in the entry next above, thus 38. (c) Integers omitted when the same as in the entry next to the left.

- (d) Integers omitted when the same as in the entry next preceding in the order of time.
- (e) Integers omitted, except where they are different from the usual ones at the place of observation.
- (f) Integers inserted occasionally and apparently without any system whatever.
- (g) A constant suppressed, and the excess or deficiency recorded, as + or -. The proper mode is that indicated by (a).
- 4. Diversity in the mode of recording the thermometer, when it is below zero, as follows:

(a) Indicated by the sign minus — placed before it, thus — 16°.

This is the proper mode.)

- (b) Indicated by the same sign placed after it thus, 16°—.
- (c) Indicated by writing it under a zero—thus  $\frac{v}{16^{\circ}}$ .
- (d) Indicated by writing it after a zero, with a comma between, thus, 0,16°.
- (c) Indicated by the word "below," or the abbreviation b written before or after it—thus 16° below, 16° b, b 16°, or below 16°.

The first (a) is the proper mode.

- 5. Departure from the printed instructions in recording the degree of cloudiness, some observers reversing the figures and using 10 to denote a clear sky, and 0, one entirely overcast; and others omitting the record altogether in the columns of cloudiness when the sky is clear, and in place of it sometimes inserting the word "clear" in the columns of "remarks," or elsewhere. Both lead to error, and should be avoided—the zero should always be inserted "in the narrow column," as directed, when the sky is clear.
  - 6. Diversity in the use of the character (0) in recording the motion of the clouds, as follows:

(a) Used to signify a calm, or that there is no perceptible motion.

(This is the correct use).

(b) Used to signify that the sky is clear, instead of inserting it in the proper column.

(c) Used to signify that no observation was taken.

(d) Used to signify that the direction in which the upper current was moving could not be determined on account of the sky being either perfectly clear or entirely overcast.

The first (a) is the correct use.

7. Want of full and proper records of the direction of the wind, some observers recording the direction only after each change, and then omitting it so long as it continues the same, merely inserting a figure to denote the force. It is better to make the record in full. Other observers record the direction towards which the wind or clouds are moving instead of indicating that from which they come. A WIND from the north, or CLOUDS moving from the north, are to be denoted by N, and from the south by S, &c.

8. Different kinds of thermometers or different exposures used for the dry and wet-bulb ther-

mometers, so that the observations are not comparable readily, if at all.

9. Diversity in the use of the dash and the sign (") as follows:

(a) To signify that the entry next above is to be repeated. (b) To signify that the entry next to the left is to be repeated.

(c) To signify that the entry next preceding in the order of time is to be repeated.
 (d) To signify nothing at all, but merely to fill a blank.

The use of these characters has caused much trouble in the reduction, and the true remedy would be to avoid them altogether, by making each record complete in itself.

10. Illegibility of the records, either from defective chirography or from being entered in pencil marks and partly erased.

#### INSTRUCTIONS IN THE USE OF THE TABLES.

The first table will enable any one to obtain at sight the dew-point and relative hu-

midity when the air and wet-bulb temperatures are given.

Example: Given  $t=60^\circ$ ;  $t'=51^\circ$ ;  $t-t'=9^\circ$ , with  $t=60^\circ$  and  $t-t'=9^\circ$ , we find from the table A, dew-point=43° and relative humidity 53 per cent. If it be desired at a high station, with a pressure of, say, 24", to correct the above values, it may be done as follows: The vapor tension corresponding to 43° dew-point is found from the second column to be .277" and the correction to this by table B at 24" is +.018'', hence the v. t. corrected for elevation is .295"; the dew-point corresponding to this v. t. is 44.5°; with this dew-point and air temperature 60° we find the relative humidity 56.5 per cent. At temperatures below 20° the nearest even tenth should be taken for t-t' and between 20° and 80° the nearest .5° should be used.

#### ABSOLUTE HUMIDITY.

If any one desires to determine the absolute humidity in grains per cubic foot he can do so by using Table C. Enter the table with the dew-point, and the absolute humidity may be taken right out; for example, a dew-point of  $43^{\circ}$  shows 3.178 grains of moisture in each cubic foot, at the temperature of t=60 and  $t'=51^{\circ}$ . It will be readily seen that when we have the dew-point given we virtually have also the vapor tension and absolute humidity; i. e., at any station the form of the curve of the above three elements will be absolutely the same. When we have lines of equal dew-point on a map of any region we have also those of equal vapor tension, and absolute humidity, or, in other words, a line of equal dew-points marked as  $49^{\circ}$  may be marked as equivalent to a vapor tension of .347'' and an absolute humidity of 3.937 grains.

#### CORRECTION OF BAROMETER READING TO 32°.

Table D.—Enter the table with the observed pressure and the temperature of the attached thermometer. For example, suppose we have given pressure 28".5 and attached thermometer 73°, the correction would be —.113"; that is, .113" must be subtracted from the reading of the barometer to reduce it to freezing.

#### REDUCTION OF BAROMETER READINGS TO SEA-LEVEL.

Table E is to be used for this reduction. The following example will show its use: Suppose the height of the station is 670 feet, and the temperature of the outside air obtained from the dry-hulb thermometer at the time of the observation is 45°, then the reduction would be .737" or .74"; this amount is to be added to the observed barometer reading to reduce it to sea-level. In using the table observers should construct one in manuscript, after learning the height of the station; this should be carried out to every degree or every two degrees of air temperature for the height of the station as found in the left-hand column.

TABLE A.—Dew-point and relative humidity.

					ABL:	_			-	197			t-bu	10.		_		÷	_	t').						
Air temperature.	Vapor tension.	Dew-point.	Ref. humidity.	Dew-point.	Dew-point.	Rel. humidity.	Dew-point.	Rel. humidity.	- Dew-point.	Rel. humidity.	- Dew-point.	Rel. humidity.	- Dew-point.	Rel. humidity.	- Dew-point.	Rel. burnidity.	- Dew-point.	Rel. humidity.	is Dew-point.	Rel, humidity,	is Dew-point.	Rel. humidity.	ie Dew-point,	Rel. humidity.	je Dew-point.	Rol. bumidity.
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-35 -34 -33 -32 -31	,008 .008 .009 .009	49 47 44 41 39	71 72 73 74 76	-69 4: -65 4: -62 4: -59 4: -56 5:		18 16 19 22 20																				
-30 -29 -28 -27 -26	.010 .010 .011 .011 .012	-36 -34 -33 -31 -30	77 78 79 80 81	-52 53 -48 56 -41 58 -41 66 -37 63	-69 -64 -59	29 33 30 39 42		5 10 14 18 22		8																
-25 -24 -23 -22 -21	.013 .013 .014 .015 .016	$\begin{array}{r} -29 \\ -27 \\ -26 \\ -25 \\ -24 \end{array}$	82 83 83 84 84	-34 6 -32 66 -30 65 -29 66 -27 70	-39 $-36$	45 48 51 53 55	-62 $-56$ $-51$	26 30 34 37 39	-73 -64	8 13 17 21 24		5 9														
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-15 -14 -13 -12 -11	.022 .023 .024 .025 .026	-17 -16 -15 -14 -13	89 89 90 90 91	-20.78 $-19.79$ $-17.80$ $-16.80$ $-15.81$	-19	66 68 69 71 72	-25 $-23$ $-22$	55 57 59 61 62	-25 -27 -28	44 46 49 51 53	-35 $-35$ $-25$	32 35 38 41 44	-58 -49 -41 -35 -32	25 28 31	-60	10 14 18 22 25	-74 -61	3 8 12 16		2 6						-
-10 - 9 - 8 - 7 - 6	,028 ,029 ,031 ,032 ,034	-12 $-11$ $-10$ $-9$ $-8$	91 91 92 92 93	-14 83 -13 83 -12 84 -10 84 - 9 85	-15 $-14$ $-12$	73 74 75 76 77	-19 $-17$ $-16$ $-15$ $-13$	64 65 67 68 70	-20 -15	55 57 59 61 63	$-\frac{23}{21}$	53	-29 -27 -25 -23 -21	42 45	-39 $-29$ $-26$	28 2 30 3 34 3 37 1 40	-41 -35 -31	19 23 26 29 32	-61 -50 -40	114 114 118 121 125	-59	2 6 10 14 18	-69	26		
- 5 - 4 - 3 - 2 - 1	.035 .037 .039 .041 .043	- 7 - 5 - 4 - 3 - 2	93 93 93 94 94	- 8 86 - 7 86 - 6 87 - 5 87 - 4 88	-10	78 79 80 81 82	-12 $-11$ $-9$ $-8$ $-7$	71 72 73 74 75	-13 -11 -10	64 65 67 68 69	-16 $-15$ $-12$ $-10$	57 59 60 62 63	-19 -17 -16 -14 -12	52 54 56	-18 -16	2 42 3 45 3 47 5 49 5 51	-25 -25 -21 -19 -17	35 38 41 43 45	-30 -27 -24 -22 -20	28 31 34 237 39	-32 $-28$ $-26$	21 24 27 30 33	-43 $-34$ $-30$	14 17 21 24 27	-35	1 1 1 2
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5 6 7 8 9	.057 .059 .062 .065 .068	4 5 6 7 8	95 95 95 96 96	3 96 4 9 5 9 6 90 7 9	2 5	86 86 87 87	3 4	81 81 82 83 83	- 1	76 77 78 79 79	1 2	71 72 73 74 75	.0	66 68 69 70 71	1 1 1 1	62 63 64 66 67	E :	57 59 60 61 63	170	52 54 56 56 57 59		47 49 51 53 55	-11 - 9 - 7	43 45 47 49 51	-13 -13 -13 - 13 - 8	4
10 11 12 13 14	.071 .074 .078 .081 .085	11	96 96 96	8 9 9 9 10 9 11 9 12 9	2 8 3 9 3 10	88 88 80 80 80	78.9	1 84 7 85 8 85 9 86 1 86		5 80 5 81 7 81 9 82 9 83		76 77 578 578 578	5	72 73 74 75 70	1	2 68 8 69 4 70 5 71 7 72	1	64 65 66 68 68	1	1 60 0 62 2 63 3 64 5 65	-1 0 2	56 58 59 61 62	- 1 - 1	52 54 56 57 59	1 4 2 1	15000
15 16 17 18 19	.088 .092 .096 .101 .105	14 15 16 17 18	97 97 97	139 149 169 179 189	6 15 6 16 6 16	90 198 191 191 191	12 13 15	2 87 3 87 4 87 5 88 6 88	11	1 83 2 84 3 84 4 85 5 85	1111	0.80 1.81 2.81 4.82 5.82	10 11 13	77 78 78 79	10	8 78 9 74 9 75 2 76 3 76	1	770 771 772 173 174	1	6 67 7 68 8 69 0 70 1 71	7	63 65 66 67 68	6	60 61 63 64 65	20 00	25556
20	.110	19		199	1	8 91		89		6 86		6 83		80		4 77	100	3 74		2,72	1:	69	10	66		9 6

TABLE A. - Dew-point and relative humidity-Continued.

					DUE		Dep	ross	ion d	ofth	o we	t bu	lb th	erm	ome	ter (	ı—ı	!').			
Air temperature,	Vapor tension.	Dew-point.	Rel. humidity.	Dew-point.	Rel, humidity.	Dew-point,	Rel, bumidity.	Dew-point.	Rel. humidity.	Dew-point.	Rel. humidity.	Dew-point,	Rel. humidity.	Dew-point.	Rel. humidity.	Dew-point.	Rel. humidity.	Dew-point, Rel. humidity.	Dew-point, Rel. humidity.	Dew-point. Rel. humidity.	Dew-point. Rel. humidity.
Air	Vap	0	.5	1.	.0	1.	.5	2.	.0	2	.5	3	.0	3	.5	4.0	0	4.5	5.0	5.5	6.0
20 21 22 22 21	.110 .114 .119 .124 .130	18 19 20 21 22	93 93 93 93 94	16 18 19 20 21	86 86 86 87 87	14 16 17 18 19	79 79 80 80 81	12 14 15 16 17	72 73 73 74 75	9 11 12 14 15	65 66 67 68 69	7 9 10 12 13	58 59 60 61 62	4 6 7 9 10	51 52 54 56 56	1 3 5 6 8	44 45 47 49 50	-3 37 -1 39 1 41 3 43 5 44	-2.34	-13 23 -10 25 - 7 28 - 5 30 - 2 32	-19 16 -15 19 -12 21 - 9 24 - 6 26
25 26 27 28 29	.135 .141 .147 .153 .159	23 24 25 26 27	94 94 94 95 95	22 23 24 25 26	88 88 89 89	20 21 22 23 24	82 82 83 83 84	18 20 21 22 23	76 76 77 78 78	16 18 19 20 21	70 71 72 73 78	14 16 17 18 20	63 65 66 67 67	12 13 15 16 18	57 59 60 61 62	10 11 13 14 16	52 53 54 56 57	7 46 8 47 10 49 11 50 13 51	4 40 6 42 8 43 9 45 11 47	0 34 2 36 4 38 6 39 8 41	- 3 28 - 1 39 1 32 3 34 5 36
30 31 32 33 34	.166 .173 .180 .187 .195	28 29 30 31 32	95 95 95 95 95	27 28 29 30 31	89 90 90 90 90	25 26 28 29 30	84 84 85 85 85	24 25 27 28 29	79 79 80 80 81	22 23 25 26 27	73 74 75 76 76	21 22 23 25 26	68 69 70 71 72	19 20 21 23 24	63 64 65 66 67	17 19 20 21 23	58 59 61 62 63	15 53 16 54 18 56 19 57 21 58	13 48 14 49 16 51 17 52 19 53	10 43 11 45 13 46 15 47 16 49	7 38 9 40 11 41 13 43 14 44
35 35 37 38 39	.203 .211 .219 .229 .237	33 35 36 37 38	95 96 96 96 96	32 34 35 36 36 37	91 91 91 92 92	31 32 33 34 35	86 86 87 87 88	30 31 32 33 34	81 82 82 83 83	28 29 30 32 33	77 78 79 79	27 28 29 31 32	72 73 74 75 75	25 26 27 29 30	68 69 69 70 71	24 25 26 28 29	64 64 65 66 67	22 59 23 60 24 61 26 62 27 63	26 54 22 55 23 56 24 57 26 58	18 50 20 51 21 52 22 53 24 54	16 45 18 47 19 48 21 50 22 51
40 41 42 43 44	.246 .256 .266 .277 .288	39 40 41 42 43	96 96 96 96 96	38 30 40 41 42	92 92 92 92 92 92	36 37 39 40 41	88 88 88 88	35 36 38 39 40	84 84 84 85 85	34 35 36 37 38	80 80 81 81 81	33 34 35 36 37	76 76 77 77 77 78	31 32 34 35 36	72 72 73 74 74	30 31 33 34 35	68 69 70 70	28 63 29 64 31 65 32 66 33 67		25 55 26 57 27 58 29 58 30 59	24 52 25 53 26 54 28 55 29 56
45 46 47 48 49	.298 .310 .322 .334 .347	44 45 46 47 48	96 96 96 96 96	43 44 45 46 47	92 93 93 93 93	42 43 44 45 46	89 89 89 89 89	41 42 43 44 45	85 86 86 86	40 41 42 43 44	82 82 82 83 83	39 40 41 42 43	78 79 79 79 79 80	37 38 40 41 42	75 75 76 76 76	36 37 39 40 41	71 72 72 73 73	34 67 36 68 37 69 38 69 39 70	33 64 35 66 36 66 37 66 38 67	31 60 33 61 34 62 36 63 37 63	30 57 32 58 33 59 35 60 06 60
50 51 52 53 54	.300 .373 .087 .402 .417	49 50 51 52 53	97 97 97 97 97	48 49 50 51 52	93 93 94 94 94	47 48 49 50 51	90 90 90 91 91	46 47 48 49 50	87 87 87 87 88	45 46 47 48 50	83 84 84 84 85	44 45 46 47 49	80 81 81 81 82	43 44 45 46 47	77 77 78 78 79	42 43 44 45 46	74 74 75 75 76	41 70 42 71 43 72 44 72 45 73	40 68 41 69 42 69 43 70 44 70	38 64 39 65 41 66 42 66 43 67	87 61 88 62 40 63 41 63 42 64
56 56 57 56 56	.432 .448 .465 .481 .499	54 55 56 57 58	97 97 97 97 97	53 54 55 56 57	94 94 94 94 94	53 54 55 56 57	91 91 91 91 92	52 53 54 55 56	88 88 88 89	51 52 53 54 55	85 85 86 86	50 51 52 53 54	82 82 83 83 83	49 50 51 52 53	79 80 80 80 81	48 49 50 51 52	76 77 78 78	47 78 48 74 49 74 50 75 51 75	49 72	44 68 45 68 47 69 48 69 49 70	43 65 44 65 46 66 47 67 48 67
8 61 83 84	.517 .536 .553 .575 .595	59 60 61 62 63	97 97 97 97 97	58 59 60 61 62	94 94 95 95 95	58 59 60 61 62	92 92 92 92 92 92	57 58 59 60 61	89 89 89 89 90	56 57 58 59 60	86 87 87 87 87	55 56 57 58 59	84 84 84 81 85	54 55 56 57 58	81 81 81 82 82	53 54 55 56 57	78 78 79 79 79	52 75 53 76 54 76 55 77 56 77	51 73 52 73 53 74 55 74 56 74	50 70 51 71 52 71 54 72 55 72	49 68 50 68 52 69 53 69 54 70
65 67 68	.616 .638 .661 .684 .707	64 65 67 68 69	97 97 98 98 98	63 64 66 67 68	95 95 95 95 95	63 64 65 66 67	92 92 93 93 93	62 63 64 65 66	90 90 90 90 90	61 62 63 64 65	87 87 88 88 88	60 61 62 63 64	85 85 85 85 86	50 51 61 62 63	82 82 83 83 83	59 60 61 62 63	80 80 81 81	61 78	57 75 58 75 59 76 60 76 61 76	59 74	55 70 56 71 57 71 58 71 59 72
11111111	.732 .757 .783 .810 .838	70 71 72 73 74	98 98 98 98 98	60 70 71 72 73	95 95 95 95 95	68 69 70 71 72	93 93 93 93 93	67 68 69 70 71	90 91 91 91 91	67 68 69 70 71	88 88 88 88	66 67 68 69 70	86 86 86 86 86	65 66 67 68 69	83 84 84 84 84	64 65 66 67 68	81 82 82 82 82	63 79 64 79 65 79 66 80 67 80	63 77 64 77 66 78	61 71, 62 75 63 75 65 75 66 76	61 72 62 72 63 73 64 73 65 74
20 12 12 12 12 12 12 12 12 12 12 12 12 12	.866 .896 .995 .957 .989	75 76 77 78 79	98 98 98 98 98	74 75 76 77 78	95 95 95 96 96	78 74 75 76 77	98 93 93 93 94	72 73 74 75 76	91 91 91 91 91	72 78 74 75 76	89 89 89 89	71 72 73 74 75	87 87 87 87 87	70 71 72 73 74	84 85 85 85 85	69 70 71 72 73	82 83 83 83	68 80 69 80 70 80 71 81 72 81	60.78 70.78 71.79		67 74 68 74 69 75
- 1	. 022	80	98	79	96	78	94	77	92	77	89	76	87	75	85	74	83	73 81	78 79	72 77	72 75

TABLE A.—Dew-point and relative humidity—Continued.

_		_			_				Dep	res	sion	of	the	wet	bul	b (t	- *	).						_	
	Dew-point.	Rel. humidity.	Dew-point.	Rel. humidity.	Dew-point.	Rel. humidity.	Dew-point.	Rel. humidity.	Dew-point.	Rel. bumidity,	Dew-point,	Rel. humidity.	Dew-point.	Rel. bumidity.	Dew-point.	Rel. humidity.	Dew-point,	Rel. humidity.	Dew-point.	Rel. humidity.	Dew-point,	Rel. humidity,	Dew-point.	Rel. humidity.	Dew-point,
-	6.0		6.	5	7.	0	7.	5	8.	0	8,	5	9.	0	9.	5	10.	0	10,	5	11.	0	11.	5	12.6
	-19 -15 -12 - 9 - 6	16 19 21 24 26	-39 -24 -18 -15 -12	9 12 15 17 20	-70 -40 -28 -23 -18	3 6 9 11 14	-62 -30	259	-67	3															
	- 3 - 1 1 3 5	28 30 32 34 36	- 8 - 5 - 3 0 2	27 29	-14 $-10$ $-7$ $-4$ $-2$	17 19 22 24 26	-22 $-17$ $-13$ $-10$ $-7$	12 14 16 19 21	-36 -26 -21 -16 -12	8 11 14 16	-60 -30 -24 -18	2 5 8 11	-54 -30	36	<b>—7</b> 0	1									
	7 9 11 13 14	38 40 41 43 44	4 6 8 10 11	37	1 3 5 7 9	28 30 32 34 35	- 3 1 2 4 6	29	- 8 - 5 - 2 0 3	18 21 23 25 27	-14 $-10$ $-7$ $-4$ $-1$	13 16 18 20 22	-23 $-16$ $-12$ $-16$ $-15$	14	-40 -25 -20 -12 10	23	-63 -32 -23 -18	2 5 7	50 -28	357	-74	2			
	16 18 19 21 22	45 47 48 50 51	13 15 17 19 20	43 44 46	11 13 15 17 18	40 42	8 10 12 14 16	36	5 8 10 12 14	29 30 32 34 35	2 4 7 9 11	24 26 28 30 32	- 2 1 4 6 8	24 26	- 7 - 3 - 0 3 5	20 22	- 8 - 5 - 1	14	$ \begin{array}{r} -20 \\ -15 \\ -10 \\ -0 \\ -3 \end{array} $	12 15	-35 -25 -17 -12 - 8	9	-39 $-20$	477	-35 -23
	24 25 26 28 29	52 53 54 55 56	22 23 24 26 27	48 49 50 51 52	20 22 23 25 26	44 46 47 48 49	18 19 21 23 24	42	16 17 19 21 23	37 38 40 41 43	13 15 17 19 21	33 35 36 38 39	11 13 15 17 19	33	10 12 14 16	29 31	12	28	0 3 6 9	19 21 22 24 26	- 4 0 3 6 8	17	<b>6</b> — 1	13	-11
	30 32 33 35 36	57 58 59 60 60	28 30 31 33 34	54 55 50	27 29 30 32 33	53	26 27 29 30 31	47 48 49 50 51	24 26 27 29 30	44 45 46 47 48	22 24 25 27 28	40 42 43 44 45	20 22 24 25 27	40	18 20 22 23 25	34 35 37 38 39	18 20 22	32 34 35	13 15 17 19 21	28 29 31 32 33	11 13 15 17 19	26 28 29	7 10 12 14 17	25 26	4 7 10 12 14
2	37 38 40 41 42	61 62 63 63 64	38	59 60 61	36 37 38	56 57 58	33 34 36 37 39	53 54 55	31 33 34 36 37	49 50 51 52 53	30 31 33 34 36	46 47 48 49 50	28 30 31 33 34	46	27 28 30 31 33	43	25 27 28 30 31	39 40 41	23 25 27 28 30	35 36 37 38 39	21 23 25 27 28	33 35 36	-23	32	17 19 21 23 25
5 5 7 8 9	43 44 46 47 48	65 66 67	45 46	63 64 64	44	61	40 41 42 44 45	57 58 59	39 40 41 42 44	54 55 55 56 57	87 39 40 41 43	53	36 37 39 40 41	50 50	34 36 37 39 40	48	-37	44 45 46	31 33 35 36 38	43	30 31 33 35 36	39 40 42	31	*37 38 39	27 28 30 31 33
1 2 3 4	49 50 52 53 54	69	51 51	66	48 50 51	63 64 64	150	61 61 62		59 60	44 45 47 48 49	57	43 44 45 47 48	54 54 55	41 43 44 43 47	51 52 53	4	49 50 51	39 41 42 43 45	47 47 48	38 38 41 42 43	45	35 41	43	35 36 38 39 41
5 6 7 8 9	55 56 57 58 59	71	5	68 69 69 69	54 53 57	66	58 56 56	63	52 54 55	62	51	59 60 60	50 52 58	58	48 49 51 52 53	55 55 56	48 50 50	53 53 1 54	47 48 50	51 51 52	45	6 49 7 49 9 50	40	47 48	44 45 46
234	60 62 63 64 65	7	6 6 6	1 70 2 7 3 7	61 62	68 69 69	59	66	59 59 61	64 65 65	57 59 60	66	56 58 58	61 61	55 57 58	5 59 50	5	5 57	54 55 56	54 55 55	5	3 50 4 53 5 53	55	2 50 3 51 4 52	51 52
56789	66 68 68 70	7 7	6 6	6 7: 7 7: 8 7:	6 6	7 71	6	6 68 6 69 7 68	63	66	66	6 6 6	66	2 63 6 63 6 63	6:	61 61	6 6	1 50 2 50 3 60	60	57	6	9 50 0 56 1 50	5 5 6	8 58 9 54 0 54	57 58 59
80	73	2 7	5 7	1 7	3 7	72	6	70	68	6	6	8 60	6	64	6	6	6	5 61	6	59	6	3 5	6	2 50	62

### REPORT OF THE CHIEF SIGNAL OFFICER.

TABLE A.—Dew-point and relative humidity—Continued.

i									De	epre	esio	n o	f the	we	t bu	lb.	(t —	<i>t'</i> ).							
Air temperature.	Dew-point.	Rel. bumidity.	Dew-point.	Rel. humidity.	Dew-point.	Rel. humidity.	Dew-point.	Rel. humidity.	Dew-point.	Rel. humidity.	Dew-point,	Rel. humidity.	Dew-point.	Rel. humidity.	Dew-point.	Rel. humidity.	Dew-point,	Rel. humidity.	Dew-point.	Rel. humidity.	Dew-point.	Rel. humidity.	Dew-point.	Rel. humidity.	Dew-point.
Airt	12	.0	12	.5	13	3.0	13	. 5	14	.0	14	. 5	15	.0	15	. 5	16	.0	16	.5	17	0.	17	.5	18.0
40 41 42 43 44	-16 -11 -6 -2 1	8 10 12 14 16	-34 -19 -13 -8 -4	6 9	-74 -32 -22 -15 -9	1 3 6 8 10	-40 -25 -17	357	-63 -28	2 4															
45 46 47 48 49	10 12 14	18 20 22 23 23 25	0 3 6 9 11	15 17 19 20 22	-5 -1 3 6 9	12 14 16 18 19	-11 -6 -1 2 5	9 11 13 15 17	-19 $-12$ $-7$ $-2$ $1$	6 8 10 12 14	-34 -21 -14 -8 -3	9	-46 -25 -16 -10	2468	-61 -28 -18	1 3 5	-80 -32	1 3							
50 51 52 53 54	17 19 21 23 25	28	14 16 18 20 23	23 25 26 28 29	11 14 16 18 20	21 22 24 25 27	8 11 13 16 18	18 20 21 23 24	5 8 11 13 16	16 17 19 20 22	0 4 7 10 13	15 16 18	-5 0 3 7 10	10 12 13 15 17	-11 -5 -1 2 6	7 9 11 13 14	-20 $-12$ $-6$ $-6$ $2$	5 7 9 10 12	$ \begin{array}{r} -38 \\ -21 \\ -13 \\ -5 \\ -2 \end{array} $	2 4 6 8 10	-46 -23 -15 -8	24 57	-53 -25 -16	1 3 5	-74 -28
55 56 57 58 59	27 28 30 31 33	34 36 37	25 26 28 30 32	31, 32 33 34 36	23 25 26 28 30	28 30 31 32 33	20 22 24 26 28	26 27 28 29 31	18 20 22 24 26	23 25 26 27 29	15 18 20 22 24	21 22 24 25 26	12 15 18 20 22	18 20 21 23 24	9 12 15 18 20	16 17 19 20 22	6 9 12 15 18	14 15 17 18 20	2 5 9 12 15	11 13 14 16 17	-3 1 5 9 12	9 11 12 14 15	-9 -4 0 4 8	7 8 10 12 13	-17 -10 -4 01 41
60 61 62 63 64	35 36 38 39 41	40 41 42	33 35 37 38 39	37 38 39 40 41	32 33 35 37 38	34 35 37 38 38	30 32 34 35 37	32 33 34 35 36	28 30 32 34 35	30 31 32 33 34	26 28 30 32 34	28 29 30 31 32	24 26 28 30 32	25 27 28 29 30	22 24 26 28 30	23 24 26 27 28	20 22 24 26 28	21 22 24 25 26	18 20 22 24 27	19 20 22 23 24	15 18 20 22 24	17 18 20 21 22	12 15 18 20 22	15 16 18 19 20	8 1 12 1 15 1 18 1 20 1
65 66 67 68	46	45 45	41 43 44 45 47	42 42 43 44 45	40 41 43 44 46	39 40 41, 42 43	38 40 41 43 45	37 38 39 40 41	37 38 40 42 43	35 36 37 38 39	35 37 37 40 42	33 34 35 36 37	34 35 37 39 40	31 32 33 34 35	32 34 36 38 39	29 30 32 33 33	30 32 34 36 38	27 29 30 31 32	28 30 32 34 36	25 27 28 29 30	27 29 31 33 34	24 25 26 27 28	25 27 29 31 33	22 23 24 25 26	23 2 25 2 27 2 29 2 31 2
70 71 72 73 74	49 51 52 53 54	50	48 49 51 52 53	46 46 47 48 48	47 48 50 51 52	44 45 45 46 47	46 47 49 50 51	42 43 43 44 45	45 46 47 49 50	40 41 42 42 43	43 45 46 48 49	38 39 40 41 41	42 43 45 46 48	36 37 38 39 40	41 42 44 45 47	34 35 36 37 38	41 41 43 44 45	33 34 35 35 36	38 39 41 43 44	31 32 33 34 35	36 38 40 41 43	29 30 31 32 33	35 36 38 40 41	27 28 30 30 31	33 20 35 2 37 20 38 20 40 30
08788	56 57 58 59 61	52 52 53	57	49 50 50 51 52	54 55 56 57 59	47 48 49 49 50	53 54 55 56 56	46 46 47 48 48	52 53 54 55 57	44 45 45 46 47	50 52 53 54 56	42 43 44 44 45	49 50 52 53 55	40 41 42 43 43	48 49 51 52 54	39 39 40 41 42	47 48 50 51 53	37 38 39 39 40	45 47 49 50 52	35 36 37 38 39	44 46 48 49 51	34 35 35 36 37	43 45 46 48 49	32 33 34 35 36	42 3 43 3 45 3 47 3 48 3
80	62	54	61	52	60	51	59	49	58	47	57	45	58	44	55	42	54	41	53	39	52	38	51	36	50 3

20 sig

### TABLE A.—Dew-point and relative humidity—Continued.

									Dep	res	ston	of	the v	wet	bul	b (1-	<b>-t</b> ').								
Air temperature.	Dew-point.	Rel. humidity.	Dew-point,	Rel. bumidity.	Dew-point.	Rel. humidity.	Dew-point.	Rel. humidity.	Dew-point.	Rel. humidity.	Dew-point.	Rel. humidity.	Dew-point.	Ref. humidity.	Dew-point.	Rel, humidity.	Dew-point.	Rel. bumidity.	Dew-point.	Rel. humidity.	Dew-peint.	Rel. bumidity.	Dew-point.	Rel. humidity.	Dew-point.
Air (	12	0	18	. 0	14	.0	15	5.0	16	3. 0	17	.0	18	.0	19	0.0	20	0.0	21	.0	20	2.0	23	0.0	24.0
80 81 82 83 84	62 63 64 65 67	54 54 55 55 56	60 61 62 64 65	51 52 52 53	58 59 61 62 63	47 48 48 49 49	56 57 59 60 61	44	54 55 57 58 59	4.2	52 53 55 56 57	39	50 51 53 54 55	35 36 37 38	47 49 50 52 53	33	45 47 48 50 51	30	42 44 45 47 49	27 28 29	39 41 43 44 46	24 25 26	36 38 40 42 43	21 22 23	32 18 35 19 37 20 39 21 41 25
85 86 87 88 89	68 69 70 71 72	56 57 57 58 58	66 67 68 70 71	53 54 54 55 55	64 66 67 68 69	50 51 51 52 52	62 64 65 66 67	47 48 48 49 49	61 63 63 64 66	44 45 45 46 46	59 60 61 63 64	41 42 42 43 44	57 58 59 61 62	38 39 40 40 41	55 56 57 59 60	36 36 37 38 38	53 54 55 57 58	33 34 34 35 36	50 52 53 55 56	31 32 32	48 49 51 53 54	30	45 47 48 50 52	25 26 27 27 27 28	42 25 44 25 46 26 48 25 49 26
90 91 92 93 94	74 75 76 77 78	59 59 59 60 60	72 73 74 75 77	56 56 57 57	70 72 73 74 75	53 53 54 54 54	69 70 71 72 73	50 50 51 51 52	67 68 69 71 72	47 48 48 49	65 67 68 69 70	44 45 45 46 46	63 65 66 67 69	41 42 43 43 44	62 63 64 66 67	39 39 40 41 41	60 61 62 64 65	36 37 37 38 39	58 59 60 62 63	35 36	56 57 58 60 61	33	53 55 56 58 59	29 30 30 31 31	51 26 53 27 54 28 56 28 57 28
95 96 97 98 99	79 80 81 83 84	60 61 61 61 62	78 79 80 81 82	58 58 58 59 59	76 77 78 80 81	55 56 56 56	75 76 77 78 79	52 53 53 53 54	73 74 75 77 78	49 50 50 51 51	71 78 74 75 76	47 48 48 49	70 71 72 73 75	44 45 45 46 46	68 69 71 72 73	42 43 43 44	66 68 69 70 71	40	64 66 67 68 70	38	63 64 65 67 68	35 36 36	61 62 63 65 66	34	59 30 60 30 61 31 63 33 64 33
100 101 102 103 104	85 86 87 88 89	62 63 63 63	83 84 85 87 88	59 60 60 60 61	82 83 84 85 86	57 57 57 58 58	80 82 83 84 85	54 54 55 55 55	79 80 81 82 83	52	77 79 80 81 82	49 49 50 50 51	76 77 78 79 81	47 47 47 48 48	74 75 77 78 79	44 45 45 45 46	78 74 75 76 78	42 43 43 44	71 72 73 75 76	39 40 40 41 41	69 71 72 73 74	37 38 38 39 39	67 69 70 71 73	35 36 36 37 37	66 33 67 33 68 34 70 34 71 35
105 106 107 108 109	90 91 92 93 94	64 64 65	90 91 92 93	61 62 62 62	87 89 90 91 92	58 59 59 59	86 87 88 89 90	56 56 57 57	85 86 87 88 89	53 54 54 54 55	83 84 85 87 88	51 52 52 52 52	82 83 84 85 86	49 49 50 50	80 81 83 84 85	46 47 47 47 48	79 80 81 82 83	44 45 45 46	77 78 80 81 82	42 42 43 43 44	76 77 78 79 80	41	74 75 76 78 79	38 38 39 39	72 35 74 36 75 36 76 37 77 37
110 111 112 113 114	96 97 98 99 100	65 65 66 66	94 95 96 97 99	62 63 63 63	93 94 95 96 97	60 60 61 61	92 93 94 95 96	58 58	90 91 92 93 95	55 56 56 56	89 90 91 92 93	53 53 63 54 54	87 89 90 91 92	50 51 51 51 52	86 87 88 89 91	48 49 49 50	85 86 87 88 89	46 46 47 47 48	83 84 85 87 88	44 45 45 45	82 83 84 85 86	43	80 81 83 84 85	40 40 41 41	79 38 80 38 81 59 82 59 83 39
115 116 117 118 119	101 102 103 104 105	66 66 67 67	100 101 102 103 104	64 64 64 64	98 99 100 101 103	61 62 62 62	97 98 99 100 101	59 59 60 60	96 97 98 99 100	57 57 57 57 58	94 95 96 97 99	54 55 55 55 55	93 94 95 96 97	52 52 53 53	92 93 94 95 96	50 50 51 51 51	90 91 93 94 95	48 49 49 49	89 90 91 92 93	46 46 47 47	88 89 90 91 92	44	86 87 88 90 91	424444	85 40 86 40 87 41 88 41 89 41
120 121 122 123 124	106 107 108 109 110	67 67 68 68	105 106 107 108 109	65 65 65 65	104 105 106 107 108	62 63 63 63 63 63 63 63 63 63 63 63 63 63	102 103 105 106 107	60 61 61 61	101 102 103 104 105	58 58 58 59 59	100 101 102 103 104	56 56 56 57 57	99 100 101 102 103	54 54 54 54 55	97 98 99 101 102	51 52 52 52 53	96 97 98 99 100	49 50 50 50 51	95 96 97 98 99	47 48 48 48 49	93 94 96 97 98	46 46 46	92 93 94 95 96	44 44 45 45	90 42 92 43 93 42 94 43 95 43
125 126 127 128 129	111 112 113 114 115	68 68 68 68	110 111 112 113 114	66 66 66	1112	64 64 64 64	109 100 110 111 112	61 62 62 63 63	106 108 109 110 111	50 60 60 60 60	105 106 107 108 110	57 57 58 58 58	104 105 106 107 108	55 55 55 56 56	103 104 105 106 107	53 53 54 54 54	101 103 104 105 106	51 51 52 52 52 52	100 101 102 103 105	49 49 50 50 50	102	48	98 99 100 101 102	AG	96 43 97 44 98 44 100 44 101 45
131 132 133	117 118 119 120 121	69	115 116 117 118 120	67 67 67 67 67		65 65 65	113 114 115 116 117	63 63		60 61 61	112 113 114	58 59 59	109 110 112 113 114	56 57 57	108 109 110 111 112	54 55 55	107 108 109 110 111	53 53	106 107 108 109 110	51 51 51	104 106 107 108 109	49 49	103 104 105 106 108	47	102 45 103 45 104 46 105 46 106 46
	222 123 124 125 126		121 122 123 124 125	68	119 120 121 122 124	66 66	121	64 64	117 118 119 120 121	62 62	116 117 118 119 120	60 60	115 116 117 118 119	58 58	117	56 56	112 113 114 115 117	54 54	112 113	52 52	110 111 112 113 114	50 50 51	109 110 112 113 114	48 49 49	107 46 108 47 110 47 111 47 112 47
40	127	71	126	69	125	66	123	61	122	62	121	60	120	58	119	56	118	55	116	53	115	51	114	49	113 48

TABLE A.—Devo-point and relative humidity—Continued.

_	i i							De	pre	esi	on e	of t	he w	et-b	ulb t	her	mom	eter	(t —	ľ).		•				_
Air temperature,	Dew-point.	Rel. humidity.	Dew-point.	Rel. humidity.	Dew-point.	Rel. humidity.	Dew-point.	Rel. humidity.	Dew-point.	Rel. humidity.	Dew-point.	Rel. humidity.	Dew-point.	Rel. bumidity.	Dew-point.	Rel. humidity.	Dew-point.	Rel, hamidity.	Dew-point.	Rel. humfdity.	Dew-point.	Rel. bumidity.	Dew-point.	Rel. humidity.	Dew-point.	Rel, humidity.
Air	24	.0	25	.0	26	.0	27	.0	28	.0	29	0,0	30.	0	31.	0	32.	0	*33.	0	34.	0	35.	0	36.	0
80 81 82 83 84	32 35 37 39 41	18 19 20 21 22	28 31 33 35 37	15 16 17 18 19	24 26 29 31 34	13 14 15 16 17	22	10 11 12 13 14	12 16 19 22 25	7 9 10 11 12	13	56789	-11 - 2 4 8 14	8 4 5 6 7	-74 -21 - 9 - 1 5	1 2 3 4 5	-54 -19 - 7	50.00	-40	1						
88 88 88 88 88 88	42 44 46 48 49	22 23 24 25 26	39 41 43 45 47	20 21 22 23 23 23	36 38 40 42 41	17 18 19 20 21	32 35 37 39 41	15 16 17 18 19	28 30 33 35 38	13 14 15 16 16	26 29 31	10 11 12 13 14	18 21 24 27 30	8 9 10 11 12	11 15 19 22 25	6 7 8 9 10	1 7 12 16 20	45678	-16 - 5 3 8 13	23456	-30 -12 - 2	1 2 3 4	-25 -10	1 2		
90 91 92 93 94	51 53 54 56 57	26 27 28 29 29	48 50 52 53 55	24 25 26 26 27	46 47 49 51 53	22 23 23 24 25	43 45 46 48 50	20 20 21 22 23	40 42 44 46 47	17 18 19 20 21	38 41	15 16 17 18 18	35 37 39	13 14 15 16 16	28 31 34 36 38	11 12 13 14 14	23 26 29 82 35	10 11 12 13	18 21 25 28 31	7 8 9 10 11	10 15 19 23 26	678	- 1 6 12 16 20	6	-20 - 7 1 8 13	3 4
95 96 97 98 99	59 60 61 63 64	30 30 31 32 32	56 58 59 61 62	28 28 29 20 30	54 56 57 59 60	25 26 27 27 28	52 53 55 57 58	23 24 25 25 26	49 51 53 54 56	21 22 23 23 24	46 48 50 52 54	19 20 21 21 21 22	44 45 47 49 51	17 18 19 19 20	40 43 45 47 48	15 16 17 18 18	37 39 41 44 46	13 14 15 16 16	33 36 38 40 43	11 12 13 14 15	32 34 37	10 10 11 12 13	-33	9 10 10 11	18 22 25 28 31	78
100 101 102 103 104	66 67 68 70 71	33 34 34 35	64 65 66 68 69	31 31 32 32 33	62 63 65 66 67	29 29 30 30 31	60 61 63 64 65	27 27 28 28 29	57 59 61 62 63	25 25 26 26 27	55 57 58 60 61	23 23 24 25 25	53 54 56 58 59	21 21 22 23 23	50 52 54 55 57	19 20 20 21 22	48 49 51 53 55	17 18 19 19 20	45 47 49 50 52	15 16 17 17 18	44 40 48	14 14 15 16 16	40 43 45	12 13 13 14 14	34 37 39 41 44	10 11 12 12 13
105 106 107 108 109	72 74 75 76 77	35 36 36 37 37	70 72 73 74 76	33 34 34 35 85	69 70 71 78 74	31 32 32 33 33	67 68 70 71 72	30 30 31 31 32	65 66 68 69 71	28 28 29 29 30	63 64 66 67 69	26 26 27 27 28	61 62 64 65 67	24 25 25 26 26	59 60 62 63 65	22 23 23 24 25	56 58 60 61 63	20 21 22 22 23	54 56 57 59 61	19 19 20 21 21	58 55 57	17 18 18 19 20	51 52 54	15 16 17 17 18	46 48 50 52 54	14 14 15 16
110 111 112 113 114	79 80 81 82 83	38 39 39 39	77 78 79 81 82 82	36 36 37 37 38	75 77 78 79 80	34 34 35 35 36	74 75 76 77 79	82 83 83 84	72 73 74 76 77	30 31 31 32 32	70 71 73 74 75	28 29 20 30 30	68 70 71 72 74	27 27 28 28 29	66 68 69 71 72	25 26 26 27 28	64 66 67 69 70	23 24 24 25 25 25	62 61 65 67 68	21 21 22 22 23 23	62	20 21 21 22 22 22	59 61	19 19 20 20 21	55 57 59 60 62	17 18 18 19
115 116 117 118 119	85 86 87 88 89	40 40 41 41 41	83 84 85 87 88	38 39 39 39 40	82 83 84 85 86	36 37 37 37 38	80 81 82 84 85	34 35 35 36 36	78 80 81 82 83	33 33 34 34	77 78 79 81 82	31 32 32 33 33	75 76 78 79 80	29 30 30 31 31	73 75 76 77 79	28 29 29 29	72 73 74 76 77	26 26 27 27 28	70 71 72 74 75	23 24 21 25 25	68 69 71 72 74	23 23 24 24 25	66 67 69 70 72	21 22 23 23 23	61 65 67 68 70	20 20 21 21 22
120 121 122 123 124	90 92 93 94 95	42 42 42 42	89 90 91 93 94	40 40 41 41 41	88 89 90 91 92	38 38 39 40	86 87 89 90 91	36 37 37 37 38	85 86 87 88 89	35 35 36 36 36	83 84 86 87 88	33 33 34 34 35	82 83 84 85 87	31 32 32 33 33	80 81 83 84 85	30 30 31 31 31	78 80 81 82 83	28 29 29 20 20 30	77 78 79 81 82	26 26 27 27 28	75 76 78 79	25 26 26 26 27	73 74 76 77 79	24 24 25 25 25 25	71 78 74 75 77	22 23 23 24 24
125 126 127 128 129	96 97 98 100 101	43 44 44 45	96 96 97 98 99	42 42 43 43	98 95 96 97 98	41	92 93 94 96 97	38 39 39 40	91 92 93 94 95	37 37 38 38	90 92	35 36 36 36	91	33 34 34 34 34 35	86 87 89 90 91	32 32 32 33 33	85 86 87 88 90	30 31 31 31 32	83 84 86 87 88	28 28 29 29 30	83 84 85	27 28 28 29 29	81 83 84	26 26 27 27 28	78 80 81 82 84	24 25 25 26
130 131 132	102 103 104 105	45 45 46 46	101 102 103 104	43 44 44 44	99 100 101 103	42 42 42 42	98 99 100 101	40 40 40 41	97 98 99 100	38 39 39 39		37 37 37 38		35 35 36 36 36	92 94 95 96 97	31 31 35	91 92 93 94 96	32 32 33 33 33	91 92 93	30 30 31 31 31	89 90 92	29 30 30 30 31	88 89 90	28 28 29 29 29	85 86 87 89 90	27 27 28
137	108 110 111	47	106 107 108 109 110	45 45	105 106 107 108 109	43 44 44	104 105 106 107 108	42 42 42	102 103 104 106 107	40 40 41	101 102 103 104 105	39 39	101 102 103		98 99 101 102 103	36 36	97 98 99 100 101	34 34 34 35 35	95 97 98 99 100	33	96 96 98	31 31 32 32 32	94 95 96	30 30 30 31 31	91 92 94 95 96	29 29 29
	100		112	0.00			109	0.01			107		0.00	38	104		103	35	101	33				31	97	

TABLE A.—Dew-point and relative humidity—Continued.

					•		D	epro	essio	n o	f the	w	t-bu	lb t	her	mor	nete	r (t	_ <i>t</i> )							_
Air temperature.	g Dew-point	o Rel. humidity.	g Dew-point.	o Rel. humidity.	g Dew-point.	e Rel. humidity.	g Dew-point.	o Rel. humidity.	Dew-point.	o Rel. humidity.	Dew-point.	o Rel. humidity.	Dew-point.	o Rel. humidity.	Dew-point.	o Rel. humidity.	Dew-point.	o Rel. humidity.	Dew-point.	o Rel. humidity.	Dow-point.	o Rel. humidity.	Dew-point.	o Rel. humidity.	Dew-point.	o Rel. humidity.
90 91 92 93 94	-20 - 7 1 8 13	1284	-46 -16 - 4	1 22 8	30 11	1 2																				<del>-</del> !
95 96 97 98 99	18 22 25 28 31	66849	10 15 19 23 27	45678	- 1 6 12 17 21		-22 - 7 1 8 14	12845	63 16 4	100	<b>30</b> 11	1														, }
100 101 102 103 104	34 37 39 41 44	10 11 12 12 13	80 82 85 88 40	9 10 11 12	25 28 31 34 37		19 23 26 29 82	56788	11 16 20 24 28	4 5 6 7 8 8 9 10	0 7 13 18 22	23456	10 15	8	- 2 6	2	28 9	1								
105 106 107 108 109	46 48 50 52 54		43 45 47 49 51	12 18 14 14 15		11 11 12 13 13	35 33 40 43 45	10 11 11 12	31 84 37 39 42	1		67899	20 24 28 81 84	84999	12 17 22 26 30	4 5 6 6	1 9 15 19 24	28445	-20 - 4 11 17	12334	-46 -12 0 8	123	-23 - 6	1	-74	1
110 111 112 113 114	55 57 59 60 62	17 18 18 19	53 55 56 58 60	15 16 17 17 18		14 15 15 16 16	47 49 51 53 55	13 14 14 15	44 46 48 50 52	11 12 12 13 14	41 43 45 47 50	10 10 11 12 12	37 39 42 44 47	8 10 10 11		7 8 9 10	28 31 84 87 40	6 7 8 8 9 10 10 11	21 25 29 32 35	55617	14 19 24 28 31	44566	11 16 21 28	200445	-15 - 1 - 7 14 19	
115 116 117 118 119	64 67 68 70	20 20 21 21 22	62 63 65 66 68	18 19 20 20	59 61 63 64 66	17 17 18 18 19	57 59 60 62 64	16 16 17 17 18	54 56 58 60 61	14 15 15 16 16	52 54 56 57 59	13 14 15 15	49 51 53 55 57	12 12 13 13	46 48 50 52 54	10 11 11 12 12	42 45 47 49 51			8 9 10 10	84 87 40 43 45		30 33 36 39 42	10 00 1-1-10 CI	24 28 31 34 37	l
120 121 122 123 124	71 73 74 75 77	22 23 24 24	69 71 72 74 75	21 21 22 22 23	67 69 70 72 73	19 20 20 21 21	65 67 68 70 71	18 18 19 19 20	63 65 66 68 69	17 17 18 18 19	61 63 64 66 67	16 16 17 17 18	59 60 62 64 65	14 15 15 16 16	56 58 60 61 63	13 14 14 15	53 55 57 59 61	12 13 13 14	50 52 54 56 58	11 11 12 12 13	47 50 53 54 56	10 10 11 11 12	44 47 49 51 53		40 43 46 48 50 2	
125 126 127 128 129	78 80 81 82 84	24 25 25 26 26 2	76 78 79 81 82	28 23 24 24 25	75 76 78 79 80	<b>ន្ទន្ទន</b> ្ទន	73 74 76 77 79	20 21 21 22 22 22	71 73 74 75 77	19 20 20 21 21	69 71 72 74 75	18 19 19 19 20	67 69 70 72 73	17 17 18 18 19	65 67 68 70 71	15 16 16 17 17	63 64 68 69	14 15 15 16 16	60 62 64 65 67	18 14 14 15 15	58 60 62 63 65	12 13 13 14	55 57 59 61 63	11 12 13 13	53 54 56 58 60 8	
130 131 182 133 134	85 86 87 89 90	27 27 28 28 28	83 85 86 87 88	25 26 26 27 27	82 83 84 86 87	24 25 25 25 25	80 81 83 84 85	2222	78 80 81 82 84	21 22 22 22 22 22 22 22 22 22 22 22 22 2	76 78 79 81 82	20 21 21 21 22	75 76 78 79 80	19 19 20 20 21	73 74 76 77 79	18 19 19 19	71 72 74 75 77	17 17 18 18 18	69 70 72 73 75	16 16 17 17	67 68 70 71 73	15 15 16 10	64 66 68 69 71	14 14 15 15	62 64 66 67 69	14
135 136 137 138 139	91 92 94 95 96 97	28 29 29 29 30	90 91 92 93 95	22 22 28 28 28	88 89 91 92 93	26 26 27 27 27	87 88 89 90 92	24 25 25 26 26	85 86 88 89 90	23 24 24 24 25 25	83 85 86 87 89	22 22 23 24 24 24	82 83 84 86 87	21 21 22 22 22 23	80 81 83 84 85	20 20 20 21 21 21	78 80 81 82 84	19 19 19 20 20 20	76 78 79 81 82	18 18 19 19	75 76 78 79 90	17 17 18 18	73 74 76 77 79	16 16 17 17	71 72 74 75 77 78	
130	91	٣	70	20		<b>2</b> 9	20	20	AI	27	<b>30</b>	24	86	20	8/	-4	80	24	86	2	82	10	0	1.	'8	

TABLE B.—Correction of vapor tension for elevation.

H	31″	80″	29"	28"	27"	26"	25″	24"	23"	22''	21"	20"	19"	18
1	001	.000	.000	.001	.001	.001	.002	.002	.002	.003	.008	.004	.004	.0
2	001	.000	.000	.001	.002	.003	.003	.004	.005	.006	.006	.007	.008	.0
3	002	001	.000	.002	.003	.004	.005	.006	.007	.008	.009	.011	.012	. 0
4	002	001	.001	.002	.004	.005	.007	.008	,010	.011	.013	.014	.016	.0
5	003	001	100	.003	. 004	.006	.008	.010	.012	.014	. 016	.018	. 020	.0
6	004	001	. 001	.003	.005	.008	.010	.012	.014	.017	.019	. 021	. 024	i . o
7	004	002	.001	.004	.006	.009	.012	.014	.017	.019	.022	.025	. 027	.0
8	005	→. 002	.001	.004	.007	.010	.013	.016	.019	.022	. 025	.028	.031	.0
9	005	002	100.	.005	.008	.011	.015	.018	.022	.025	.028	.032	. 035	.0
10	006	002	. 001	.005	.009	.013	.017	.020	. 024	.028	. 032	.035	. 039	.0
11	007	003	.002	.006	.010	.014	.018	.022	. 026	. 031	. 035	.089	. 043	9.
12	007	003	.002	.006	.011	.015	.020	.024	.029	. 033	.038	.042	.047	0.
13	008	003	.002	.007	.012	.017	.021	.026	.031	.036	.041	.046	.051	9.
14 15	009 009	003 004	.002	.007	.013	.018	.023	.028	.034	.039	.044	.050	.055	8:
16	010	004	. 002	.008	.014	.020	.026	. 032	. 038	.045	.051	. 057	. 063	
17	011 011	004	.002	.009	.015	.022	.028	.034	.041	.047	.054	.060	.067	1:0
18	011 011	004	.003	.009	.016	.023	.030	.037	.043	.050	.057	.064	.071	1:6
19	011 012	005	.003	.010	.017	.024	.031	039	.046	.053	.060	J/067	.074	1:0
20	012 012	005	.003	.010	.018	.025	.033	.041	.048	.056	.063	.071	.078	1:0
21	013	005	.003	.011	.019	.027	.035	.043	.051	.058	.066	.074	.082	
22	014	005	.003	.011	.020	.028	. 036	. 045	.053	.061	.070	.078	.086	1.0
23	014	006	.003	.012	.021	.029	.038	.047	.055	.064	.073	.081	.000	1.0
24	015	006	.003	.012	.021	.031	.040	.049	.058	.067	.076	. 085	. 094	1 .:
25	015	006	.003	. 013	.022	.032	.041	.051	.060	.070	.079	. 088	.098	
26	016	006	.004	.013	.023	. 033	.043	. 053	. 063	.072	. 082	. 092	.102	
27	<b>—.017</b>	006	.004		.024	.034	.045	.055	.065	. 075	.085	. 096	.106	
28	017	007	.004	. 014	.025	.036	.046	.057	.067	.078	.089	.099	. 110	
29	<b>—.018</b>	—. 0∪7	, (K)4	.015	.026	.037	.048	.059	.070	.081	.092	. 103	.114	1 .
30	019	007	. 004	.015	.027	. 038	.050	.061	.072	.084	.095	. 106	.118	
31	019	007	.004	.016	. 028	. 039	.051	.063	. 075	. 086	.098	.110	. 121	١.
32 33	020	007	.004	.017	.029	.041	.053	.065	.077	.089	.101	. 113	. 125	1.
33	020	008	.005	.017	. 030	.042	.054	.067	.079	.092	. 104	. 117	. 129	
34	021	008	.005	.018	.030	.043	.056	.069	.082	. 095	.107	. 120	. 133	1.
35	022	008	,005	.018	.031	.045	.058	.071	.084	.097	.111	. 124	. 137	•
36	022	009	.005	.019	.032			.073	.087	. 100	.114	.127	.141	.
37	023	009	.005	.019	.033	.047	.061	.075	.089	. 103	.117	. 131	.145	
38	023	009	.005	.020	.034	.048	.063	.077	. 091	. 106	.120	. 185	.149	١.
89	024	009	.005	.020	.035	.050	.064	.079	.094	.109	. 123	. 138	. 153	i •
10	· 025	010	,006	.021	.036	.051	.066	.061	.096	1.111	, 126	.142	. 157	١.

TABLE C .- Dew-point and absolute humidity.

#### [Grains per cubic foot.]

		<del></del>	<del></del>	[Grains	per cub	ie 100t. j			-	
Dew-point.	0	1	2	3	4	5	6	7	8	9
-30	. 131	. 124	. 117	. 111	. 105	.099	.094	. 089	. 084	. 090
-20	. 219	. 208	. 198	. 188	. 179	.170	.161	. 153	. 145	. 138
-10	. 856	. 340	. 824	. 309	. 294	.280	.267	. 254	. 242	. 230
- 0	. 565	. 540	. 516	. 493	. 471	.450	.430	. 410	. 391	. 373
+ 0	. 565	. 591	. 618	. 646	. 675	.705	.786	. 767	. 800	. 835
10	. 878	. 911	. 950	. 991	1.083	1.077	1. 122	1. 169	1. 218	1, 268
20	1, 320	1. 874	1. 431	1. 489	1.549	1.611	1. 676	1. 743	1. 812	1, 883
30	1, 957	2. 084	2. 113	2. 195	2.280	2.367	2. 457	2. 550	2. 646	2, 746
40	2, 849	2. 955	3. 065	3. 178	3.295	3.415	3. 539	3. 669	3. 801	3, 937
50	4, 077	4. 223	4. 373	4. 527	4.686	4.850	5. 018	5, 192	5. 871	5, 526
60 70 80 91	5, 746 7, 961 10, 986 14, 794 19, 771	5. 942 8. 241 11. 278 15. 238 20. 340	6. 143 8, 509 11, 628 15, 693 20, 922	6. 850 8. 784 11. 988 16. 160 21. 518	6. 564 9. 067 12. 858 16. 637 22. 129	6, 784 9, 358 12, 737 17, 128 22, 756	7. 010 9. 657 13. 127 17. 631 23. 397	7. 243 9. 964 13. 529 18. 146 24. 053	7. 482 10. 279 13. 941 18. 674 24. 725	7, 728 10, 603 14, 362 19, 216 25, 413
110	26, 118	26, 839	27.576	28, <b>330</b>	29. 102	29, 894	30, 706	81.528	32. 874	83. 238
120	34, 124	35, 026	35,951	<b>36, 895</b>	37. 860	89, 847	39, 855	40.884	41. 987	40. 013

TABLE D.—Correction to be applied to barometers with brass scales, extending from the cistern to the top of the mercurial column, to reduce the observation to 32° Fahrenheit.

ture.								Inche	8.						
Temperature.	24. 0.	24.5.	25. 0.	25.5.	26. 0.	26. 5.	27.0	27.5	28.0	28.5	29.0	29.5	80.0	30.5	31.0
œ	+	+	+	+	+	+	.069	.071	+	+	+	+	+	' <b>+</b>	.080
ņ	. 061	.063	.064 .062	.065 .063	+ .067 .064	.068	.069	.071	.072 .069	.078	.074	.076	.077	.078 .076	.080
1 2	.059	.061	.060	.061	1.062	.063	.064	.066	.067	.071	.072	.078	.074	.073	.074
3	. 055	.056	.060 .057 .055	.061	.060	.061	.062	.063	.064	.065	.067	.068	.069	.070	.077 .074 .071 .068
4	. 053	.054	.065	.056	.057	.058	. 059	. 061	.062	.063	.064	. 065	.066	.067	.068
5	.051	.052	.053 .051	.054	.055	. 056 . 054	.057	.058	.059	.060	.061	.062	.068	.065	.066
6	. 049 . 046	.050	.048	.052	.050	.051	.052	.053	.054	.058	.056	.060 .057 .054	.06L	.059	.080
่	.044	.047 .045	.046	.047	.048	.049	.050	.051	.054	.055	.054	.054	. 055	.056	. 057
9	. 042	. 043	.044	.045	.046	.046	. 047	.048	.049	.050	.051	. 052	.053	.054	.034
10	. 040	.041	.042	.042	.043	.044	. 045	.046	.047 .044 .042	.047	.048	.049	.050	.051	. 052
11	. 038	.039	.039	.040	.041	.042	.042	.043	.044	.045	.046	.046	.047	.048	.049
12 13	. 036	.036	.037	.038	.036	.037	.038	.041	.039	.042	.043	.044	.043	.043	.046
14	. 031	.032	.033	.033	.034	. 085	.035	.096	.037	.037	.038	.038	.039	.040	.043
15	. 029	.030	.030	.031	.032	. 032	.033	.033	.034	.085	.035	.086	.036	.037	.038
16	. 027	.028	.029	.029	. 029	.030	030	.031	. 032	.032	.033	.033	.034	.034	. 035
17	.025	.025	. 026	.026	.029 .027 .025	.027	.028	.028	.032 .029 .026	.030	.030	.031	.034 .081 .028	.032	.032
18 19	. 023	.021	.021	.022	.022	.023	.023	.024	.024	.024	.025	.025	026	.026	.035 .032 .029 .027
20	.018	.019	.019	. 029	.020	. 020	.021	. 021	. 021	.022	.022	003	.023	.023	004
21	.016	.017	.017	.017	.018	.018	.018	.019	.019	.019	.020	.023	.020	.021	. 021
22	.014	.014	.015	.015	.015	016	.016	.016	.016	.017	.017	.017	.018	.018	.018
23 24	. 012 . 010	.012	.012	.013	.013	.013	.013	.014	.014	.014	.014	.015	.015	.015	. 024 . 021 . 018 . 015 . 013
			:	1	.008	ŀ		.009	.009		ì	1	i	i .	4
$\frac{25}{26}$	.008	.008	.008	.008	.006	.008	.009	006	.006	.009	.009	.009	.009	.010	.010
27	.003	.003	.003	.003	.004	.004	.004	.004	.006 .504	.004	.007	.004	.004	.004	.007
28	.001	.001	.001	. 001	.001	.001	.001	.001	.000	.001	.001	,001	.001	.001	.001
-9	. 001	.001	. 001	. 001	.001	.001	. 001	100.	.001	.001	.001	.001	.001	.001	.001
30	. 003	.003	.003	.004 .006 .008 .010	.004	.004	.004	.004	.004	.004	.004	.004	.004	.004	.004 .007 .010
31 32	.005	.006	.006	.006	.006	.006	.006	.006	1.006	.007	.007	.007	.007	.007	.007
33	. 008 . 010	.010	.010	.010	.011	.008	.011	.011	.009	.009	.009	.009	.009	.010	.012
34	.012	.012	.012	.013	.013	.013	.014	.014	.014	.014	.015	.015	.015	.015	.015
35	. 014	.014	.015	.015	.015	.015	.016	.016	.016	.017	.017	.017	.018	.018	.018
36	. 016	.017	.017	.015 .017	. 017	1.018	.018	.019	.019	.019	. 020	.020	.020	.021	.021
37 38	.018	.019	.019	1.019	.020	.020	.021	. 021	.021	.022	. 022	.022	.023	.023	.024
39	. 020 . 023	.023	.024	.022	.024	.025	.023	.026	.024	.027	.025	.025	.026	. 029	. 029
40	. 025	.025	.026	. 026	.027	.027	.028	.028	.029	.029	.030	.030	.031	. 031	. 039
41	. 027	. 027	, 028	.029	. 029	.030	.030	. 031	.031	.032	.033	.033	.034	. 034	. 032
42	. 029	.030	.030	.031	.081	.032	.033	, 033	.034	. 034	.035	.036	.036	037	037
44 44	.031	.032	.032	.033	.084	.034	.035	.036	.036	.037	.039	.038	.039	.040	.040
45	. 035	.036	.037	.088	.038	.039	.040	.041	.041	.042	.043	.044	.044	.045	.046
46	. 038	. 038	. 039	.040	.041 .043 .045	.042	.042 .045	.043	.044	.045	.045	.046	.047	.048	049
47	.040	.041	.041	.042	.043	.042 .044 .046	.045	.046	.046	.047	.048	.049	.050	.051	.051
48 49	.042	.043	.044	.045	.048	.049	.047	.050	.049	.052	.053	.052	.052	.053	.054
			1	1	1	i	1	1				1	i	1	1
50	.046	.047	.048	.049	.050	.051	.052	.053	.054	.055	.056	.057	.058	.059	.060

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TABLE D-Continued.

ture.							Ir	ches.							
Temperature.	24.0	24.5	25.0	25, 5	26.0	26.5	27.0	27.5	28.0	28.5	29.0	29.5	80.0	30.5	81.0
51 52 53	. 048 . 060 . 063	.049 .052 .054	.050 .053 .055	.051 .054 .056	.052 .053 .057		.054 .057 .059	.055 .058 .060		. 057 . 060 . 063	.058 .061 .064	.059 .062 .065	.060 .063 .066	.061 .064 .067	.062 .063 .068
54 55 56 57 58 59	.055 .057 .059 .061 .062 .065	.056 .058 .060 .062 .065 .067	.057 .059 .061 .064 .066 .068	.058 .060 .063 .065 .067	.059 .062 .064 .066 .069	.060 .063 .065 .068 .070	.062 .064 .066 .069 .071	.063 .065 .068 .070 .073 .075	.064 .066 .069 .071 .074 .076	.065 .069 .070 .073 .075 .078	.066 .069 .071 .074 .077	.067 .070 .073 .075 .078	.068 .072 .074 .076 .079 .082	.070 .072 .075 .078 .081 .083	.071 .073 .076 .079 .082 .085
60 61 62 63 64	. 068 . 070 . 072 . 074 . 076	.069 .071 .073 .079	.070 .073 .075 .077	.072 .074 .076 .079	.073 .075 .078 .080 .082	.075 .077 .079 .082 .084	.076 .078 .081 .083	.077 .090 .083 .085 .087	.079 .081 .084 .086	.090 .083 .085 .088	.082 .084 .087 .089 .092	.083 .086 .088 .091	.085 .087 .090 .093 .095	.086 .089 .091 .094 .097	.087 .090 .098 .096
65 66 67 68 69	. 078 . 080 . 063 . 065 . 067	.090 .082 .084 .086	. 082 . 064 . 086 . 088 . 090	.083 .085 .098 .090	.065 .067 .089 .092 .094	.086 .089 .091 .094 .096	.088 .090 .093 .095 ,098	.090 .092 .095 .097	.091 .094 .096 .099 .101	.093 .096 .098 .101 .103	.095 .097 .100 .102 .105	.096 .099 .102 .104	.098 .101 .103 .106 .109	.100 .102 .105 .108 .110	101 .104 .107 .109 .112
70 71 72 73 74	.089 .091 .093 .095 .097	.091 .093 .095 .097	.098 .095 .097 .099 .102	.095 .097 .099 .101	.096 .099 .101 .103 .106	.098 .101 .103 .105	.100 .102 .105 .107 .110	.102 .104 .107 .109 .112	.104 .106 .109 .111 .114	.106 .108 .111 .113 .116	.108 .110 .113 .115	.109 .112 .115 .117 .120	.111 .114 .117 .119 .122	.118 .116 .119 .121	.115 .118 .120 .123 .126
75 76 77 78 79	.100 .102 .104 .106 .108	. 102 . 104 . 106 . 108 . 110	.104 .106 .108 .110 .113	.106 .108 .110 .113 .115	.108 .110 .112 .115 .117	.110 .112 .115 .117 .119	.112 .114 .117 .119 .122	.114 .117 .119 .122 .124	.116 .119 .121 .124 .126	.118 .121 .123 .126 .128	.120 .123 .126 .128 .131	.122 .125 .128 .130 .133	.125 .127 .130 .133 .135	127 .129 .132 .135 .137	. 129 . 131 . 134 . 137 . 140
80 81 82 83 84	.110 .112 .114 .117	, 113 .115 .117 .119 .121	.115 .117 .119 .121 .124	.117 .119 .122 .124 .126	.119 ,122 .124 .126 .129	.122 .124 .126 .129 .131	.124 .126 .129 .131 .134	.126 .129 .131 .134 .136	.129 .131 .134 .136 .139	.131 .134 .136 .139 .141	.133 .136 .138 .141 .144	.136 .138 .141 .143 .146	.138 .141 .143 .146 .149	.140 .143   .146   .148   .151	. 143 . 145 . 148 . 151 . 154
85 86 87 88 89	. 121 . 123 . 125 . 127 . 129	.123 .126 .128 .130 .132	.126 .128 .130 .133 .135	. 128   . 131   . 133   . 135   . 137	.131 .133 .136 .138 .140	.133 .136 .138 .141 .143	.136 .138 .141 .143 .146	.139 .141 .143 .146 .148	.141 .144 .146 .149 .151	. 144 . 146 . 149 . 151 . 154	.146 .149 .151 .154 .156	.149 .151 .154 .157 .159	. 151 . 154 . 157 . 159 . 162	.154 .156 .159 .162 .165	. 156 . 159 . 162 . 165 . 167
90 91 92 93 94	. 131 . 134 . 136 . 138 . 140	. 134 . 136 . 139 . 141 . 148	.137 .139 .141 .144	.140 .142 .144 .147 .149	.142 .145 .147 .149 .152	.145 .148 .150 .152 .155	.148 .150 .153 .155 .157	. 151 . 153 . 156 . 158 . 161	.153 .156 .158 .161 .163	.156 .159 .161 .164 .166	.159 .162 .164 .167 ,169	.162 .165 .167 .170 .172	.164 .167 .170 .172 .175	.167 .170 .172 .175 .177	.170 .173 .175 .178 .180
95 96 97 98 99	.142 .144 .146 .148 .151	.145 .147 .149 .152	.148 .150 .152 .155 .157	.151 .153 .156 .158 .160	.154 .156 .159 .161 .163	.157 .159 .162 .164 .166	.160 .162 .165 .167	.163 .165 .168 .170	.166 .168 .171 ,173 .176	.169 .171 .174 .176 .179	.172 .174 .177 .179 .182	.175 .178 .180 .183 .185	.178 .181 .183 .186 .188	.180 .183 .186 .188 .191	. 183 . 183 . 189 . 191 . 194
100	. 153	. 156	. 159	.162	. 165	.169	.172	.175	.178	. 181	.184	.188	. 191	. 194	. 197

TABLE E.—Table for reducing observations of the barometer to sea-level, correction additive.

ti.			3	Cemper	ature o	f exter	nal air-	-degre	es Fahr	renheit			
Height feet.	-20°	-10°	00	100	20°	30°	40°	50°	60°	70°	80°	<b>90</b> °	100°
10 20 30 40	. 013 . 026 . 039 . 052	.013 .025 .034 .050	.012 .025 .037 .049	.012 .024 .036 .048	.012 .023 .035 .047	.012 .023 .034 .046	.011 .023 .034 .045	.011 .022 .033 .044	.011 .022 .032 .043	.011 .021 .082 .042	.010 .021 .081 .041	.010 .020 .030 .040	.010 .020 .031
50 60 70 80 90	.065 .077 .090 .103 .116	.063 .076 .088 .101 .113	.061 .074 .086 .098	.060 .072 .084 .096 .108	.059 .070 .082 .094 .105	.058 .069 .081 .092	.056 .068 .078 .090	.055 .066 .077 .088 .099	.054 .065 .076 .086 .097	.053 .068 .074 .084 .095	.052 .062 .072 .082 .093	.051 .061 .071 .081 .091	.05 .05 .06 .07
100 110 120 130 140	.129 .142 .155 .168 .181	.126 .139 .151 .164 .176	.123 .135 .148 .160 .172	.120 .132 .144 .156 .168	.117 .129 .140 .152 .164	.115 .126 .139 .149 .161	.112 .123 .134 .146 .157	.110 .121 .132 .148 .154	.108 .119 .129 .140 .151	. 105 . 116 . 126 . 137 . 147	.108 .113 .124 .184 .144	. 101 . 111 . 121 . 181 . 141	.09 .10 .11 .12
150 160 170 180 190	.194 .206 .219 .232 .245	.189 .201 .214 .227 .239	.185 .197 .209 .222 .234	.180 .192 .204 .216 .228	.176 .187 .199 .211 .222	.172 .183 .195 .206 .218	.168 .179 .190 .202 .213	.165 .176 .187 .198 .209	. 162 . 172 . 183 . 194 . 204	.158 .168 .179 .189 .200	. 155 . 165 . 175 . 185 . 196	. 152 . 162 . 172 . 182 . 192	.14 .13 .16 .17
200 210 220 230 240	. 258 . 271 . 284 . 296 . 309	.252 .264 .277 .289 .302	. 246 . 258 . 270 . 283 . 295	.210 .252 .264 .276 .283	. 234 . 246 . 257 . 269 . 281	.229 .240 .252 .263 .275	.224 .235 .246 .257 .269	.220 .231 .242 .253 .264	.215 .226 .236 .247 .258	.210 .221 .231 .242 .252	. 206 . 216 . 227 . 287 . 248	.202 .212 .222 .232 .242	. 19 . 20 . 21 . 22 . 23
250 260 270 280 290	.322 .335 .348 .360 .373	.814 .327 .339 .852 .364	. 307 . 319 . 331 . 344 . 356	.300 .311 .323 .335 .347	.293 .304 .316 .328 .339	. 286 . 297 . 309 . 320 . 332	.290 .291 .302 .814 .325	.275 .285 .296 .307 .318	.269 .279 .290 .301 .311	.258 .273 .284 .294 .305	.258 .268 .278 .288 .299	. 253 . 263 . 273 . 263 . 298	. 24 . 25 . 26 27
300 310 320 330 340	.386 .399 .412 .424 .437	.877 .389 .402 .414 .427	.368 .380 .392 .404 .416	.359 .371 .383 .395 .407	351 363 . 374 . 386 . 397	.343 .354 .366 .377 .389	.336 .347 .358 .369 .380	. 329 . 340 . 351 . 362 . 373	.822 .833 .343 .354 .365	.815 .826 .336 .347 .357	.309 .319 .329 .340 .350	.303 .313 .323 .333 .343	. 25 . 30 . 31 . 82 . 33
350 360 370 380 390	. 450 . 463 . 476 . 488 . 501	. 439 . 451 . 464 . 476 . 489	.429 .441 .453 .465 .477	.419 .430 .442 .454 .466	.409 .421 .432 .444 .455	.400 .411 .423 .434 .446	.392 .403 .414 .425 .436	. 384 . 394 . 405 . 416 . 427	.376 .386 .397 .408 .418	.368 .378 .389 .899 .410	.360 .870 .380 .391 .401	.853 .868 .873 .883 .393	34 35 .34 .35 .35
400 410 420 430 440	.514 .527 .539 .552 .565	.501 .513 .526 .538 .551	. 489 . 501 . 513 . 525 . 537	.478 .490 .502 .513 .525	.467 .479 .490 .502 .513	.457 .468 .480 .491 .502	.447   .458   .469   .480   .491	.438 .449 .460 .470	.429 .440 .450 .461 .471	.420 .430 .441 .451 .462	.411 .421 .431 .442 .452	.408 .413 .423 .438 .443	.4
450 460 470 480 490	.578 .590 .603 .616	.563 .575 .588 .600 .613	.550 .562 .574 .586	.537 .549 .561 .572 .584	.525 .537 .548 .560 .571	.513 .525 .536 .547 .559	.503 .514 .525 .536 .547	.492 .503 .514 .524 .535	.482 .493 .508 .514 .524	.472 .482 .493 .503 .514	.462 .472 .482 .493 .503	. 453 . 463 . 473 . 468 . 493	. 4 . 4 . 4
500 510 520 580 540	.641 .654 .666 .679 .691	.625 .637 .650 .662 .675	.610 .622 .634 .646	.596 .608 .620 .681 .643	.583 .594 .606 .617	.570 .581 .593 .604 .615	.558 .569 .580 .591 .602	.546 .557 .568 .578 .589	.535 .545 .556 .566	. 524 . 584 . 545 . 555 . 565	.513 .523 .533 .544 .554	.508 .513 .523 .533 .543	. 41 . 5 . 5 . 5
550 560 570 580 590	.701 .717 .729 .742 .754	.687 .699 .712 .724 .787	. 670 . 683 . 695 . 707 . 719	.656 .667 .579 .690 .702	. 640 . 652 . 663 . 675 . 686	.626 .638 .649 .660	.618 .624 .635 .646 .657	.600 .611 .622 .632 .643	.587 .598 .608 .619	.575 .586 .596 .606 .617	.564 .574 .584 .595 .605	.558 .563 .573 .583 .593	.54 .56 .56
600 610 620 630 640	.767 .780 .792 .805 .817	.749 .761 .774 .786 .798	.731 .743 .755 .767 .779	.714 .726 .738 .749 .761	.709 .721 .732 .744	.688 .694 .705 .717 .728	.668 .679 .690 .701	. 654 . 665 . 675 . 686 . 697	.640 .650 .661 .671	.627 .637 .648 .658	.615 .625 .635 .645	.603 .613 .623 .633 .643	. 56 . 60 . 63
650 660 670 680 690	. 830 . 843 . 855 . 868 . 880	.811 .823 .835 .847 .860	.791 .808 .815 .827 .839	.778 .785 .797 .808 .820	.755 .767 .778 .790 .801	.789 .750 .761 .773	.723 .734 .745 .756 .767	.708 .718 .729 .740 .750	.692 .703 .713 .724 .734	.679 .689 .699 .709 .720	.666 .676 .686 .606	.658 .662 .672 .682 .692	.64 .63

TABLE E-Continued.

# # #				Temp <b>e</b>	rature	of exte	rnal air	-degre	es Fab	renheit			
Height . feet.	-20°	-10°	0°	100	20°	30°	40°	50°	60°	70°	80°	90°	1000
700 710 720 730 740	. 893 . 905 . 918 . 930 . 943	.872 .884 .896 .909	.851 .863 .875 .887 .899	. 882 . 844 . 855 . 867 . 879	.818 .824 .836 .847 .859	. 795 . 806 . 817 . 829 . 840	.778 .789 .800 .811 .822	.761 .772 .782 .793 .804	.745 .755 .766 .776 .787	.730 .740 .751 .761	.716 .726 .736 .746 .756	.702 .712 .722 .732 .742	.689 .698 .708 .718 .728
750	.955	. 933	.911	.891	. 870	.831	.833	.815	.797	.782	.767	.752	.738
760	.948	. 945	.922	.902	. 881	.862	.843	.825	.808	.792	.777	.761	.747
770	.980	. 957	.934	.914	. 893	.873	.854	.836	.818	.802	.787	.771	.757
780	.993	. 970	.946	.926	. 904	.885	.865	.847	.829	.812	.797	.781	.767
790	1.005	. 982	.958	.937	. 916	.896	.876	.857	.839	.823	.807	.791	.776
800 810 820 830 840	1.018 1.030 1.043 1.055 1.068	.994 1.006 1.018 1.031 1.043	.970 .982 .994 1.006 1.018	. 949 . 961 . 972 . 984 . 995	. 927 . 938 . 950 . 961 . 973	.907 .918 .929 .940 .951	.887 .896 .909 .920 .931	. 868 . 878 . 889 . 900 . 911	.850 .860 .871 .881 .892	.833 .843 .854 .864 .874	.817 .827 .837 .847 .857	.801 .811 .821 .831	. 786 . 796 . 805 . 815 . 825
850 860 970 830 890	1.090 1.093 1.105 1.118 1.130	1.055 1.067 1.079 1.092 1.104	1.030 1.041 1.053 1.065 1.077	1.007 1.019 1.030 1.042 1.053	.984 .995 1.007 1.018 1.030	. 962 . 974 . 985 . 996 1. 007	. 942 . 952 . 963 . 974 . 985	. 922 . 932 . 943 . 954 . 964	.902 .913 .923 .931 .944	. 895 . 893 . 903 . 915 . 926	.867 .877 .887 .897	.851 .860 .870 .880 .890	. 835 . 844 . 854 . 864 . 873
900	1. 143	1.116	1. 089	1.065	1.041	1.018	. 996	. 975	. 955	. 936	.917	.900	. 883
910	1. 155	1.128	1. 101	1.077	1.052	1.029	.007	. 986	. 965	. 946	.927	.910	. 893
920	1. 168	1.140	1. 113	1.068	1.064	1.040	1.018	. 996	. 976	. 956	.937	.920	. 902
930	1. 180	1.152	1. 125	1.100	1.075	1.051	1.029	1. 007	. 986	. 967	.947	.929	. 912
940	1. 193	1.164	1. 137	1.111	1.086	1.062	1.040	1. 017	. 997	. 977	.957	.939	. 941
950	1. 205	1.177	1.149	1. 123	1.098	1.074	1.051	1.028	1.007	. 987	. 967	. 949	.931
960	1. 217	1.189	1.160	1. 135	1.109	1.085	1.061	1.039	1.017	. 997	. 977	. 959	.841
970	1. 230	1.201	1.172	1. 146	1.120	1.096	1.072	1.049	1.028	1. 007	. 987	. 969	.950
990	1. 242	1.213	1.184	1. 158	1.131	1.107	1.083	1.060	1.038	1. 018	. 997	. 978	.960
990	1. 255	1.225	1.196	1. 169	1.143	1.118	1.094	1.070	1.049	1. 028	1. 007	. 988	.969
1,000	1. 267	1. 237	1. 208	1. 181	1. 154	1. 129	1. 105	1.081	1.059	1.038	1.017	.998	. 979
1,010	1. 279	1. 249	1. 220	1. 192	1. 165	1. 140	1. 116	1.092	1.069	1.048	1.027	1.008	0, 989
1,020	1. 292	1. 261	1. 232	1. 204	1. 177	1. 151	1. 127	1.102	1.080	1.058	1.037	1.018	0, 998
1,030	1. 304	1. 273	1. 243	1. 215	1. 188	1. 162	1. 137	1.113	1.090	1.069	1.047	1.027	1, 008
1,040	1. 317	1. 285	1. 255	1. 227	1. 199	1. 173	1. 148	1.123	1.101	1.079	1.037	1.037	1, 017
1.050	1.329	1. 298	1. 267	1. 238	1.211	1, 184	1, 159	1. 134	1, 111	1.069	1, 067	1. 047	1.027
1.060	1.341	1. 310	1. 279	1. 250	1.222	1, 195	1, 170	1. 145	1, 121	1.099	1, 077	1. 057	1.037
1.070	1.354	1. 322	1. 291	1. 261	1.233	1, 206	1, 181	1. 155	1, 132	1.109	1, 087	1. 067	1.046
1.080	1.366	1. 834	1. 302	1. 273	1.244	1, 217	1, 191	1. 166	1, 142	1.120	1, 097	1. 076	1.056
1.090	1.379	1. 346	1. 314	1. 284	1.256	1, 228	1, 202	1. 176	1, 153	1.130	1, 107	1. 086	1.065
1,100	1.391	1.358	1. 326	1. 296	1. 267	1, 239	1, 213	1. 187	1, 163	1. 140	1. 117	1.096	1.075
1,110	1.403	1.370	1. 338	1. 307	1. 278	1, 250	1, 224	1. 198	1, 173	1. 150	1. 127	1.196	1.085
1,120	1.416	1.382	1. 350	1. 319	1. 289	1, 261	1, 235	1. 208	1, 184	1. 160	1. 137	1.115	1.094
1,130	1.428	1.394	1. 361	1. 330	1. 301	1, 272	1, 245	1. 219	1, 194	1. 170	1. 147	1.125	1.104
1,140	1.440	1.406	1. 373	1. 342	1. 312	1, 283	1, 256	1. 229	1, 204	1. 180	1. 157	1.135	1.113
1, 150	1. 453	1.418	1. 385	1.353	1.323	1.294	1. 267	1. 240	1. 215	1. 191	1.167	1, 145	1. 123
1, 160	1. 465	1.430	1. 397	1.365	1.334	1.305	1. 278	1. 251	1. 225	1. 201	1.177	1, 154	1. 133
1, 170	1. 477	1.442	1. 409	1.376	1.345	1.315	1. 289	1. 261	1. 235	1. 211	1.187	1, 164	1. 142
1, 180	1. 489	1.454	1. 420	1.388	1.357	1.327	1. 299	1. 272	1. 245	1. 221	1.197	1, 174	1. 152
1, 190	1. 502	1.466	1. 432	1.399	1.368	1.338	1. 310	1. 282	1. 256	1. 231	1.207	1, 183	1. 161
1, 200	1,514	1.478	1.444	1.411	1.379	1.349	1.321	1. 293	1. 266	1.241	1. 217	1. 193	1.171
1, 210	1.526	1.490	1.456	1.422	1.390	1.360	1.332	1. 303	1. 276	1.251	1. 227	1. 203	1.180
1, 220	1.539	1.502	1.467	1.434	1.401	1.371	1.342	1. 314	1. 288	1.261	1. 237	1. 212	1.190
1, 230	1.551	1.514	1.479	1.445	1.413	1.382	1.353	1. 324	1. 297	1.271	1. 247	1. 222	1.199
1, 240	1.463	1.526	1.491	1.457	1.424	1.393	1.364	1. 335	1. 307	1.281	1. 257	1. 232	1.209
1, 250	1.576	1.538	1.502	1.468	1.435	1.404	1. 374	1, 345	1, 317	1. 291	1. 266	1. 242	1. 218
1, 260	1.588	1.550	1.514	1.479	1.446	1.415	1. 385	1, 356	1, 328	1. 302	1. 276	1. 251	1. 228
1, 270	1.600	1.562	1.526	1.491	1.457	1.426	1. 396	1, 366	1, 338	1. 312	1. 286	1. 261	1. 237
1, 280	1.612	1.574	1.538	1.502	1.469	1.437	1. 407	1, 377	1, 348	1. 322	1. 296	1. 271	1. 247
1, 290	1.625	1.586	1.549	1.514	1.480	1.448	1. 417	1, 387	1, 359	1. 332	1. 306	1. 280	1. 256
1,300	1.637	1.598	1.561	1.525	1.491	1.459	1. 428	1, 398	1. 369	1.342	1. 316	1.290	1. 266
1,310	1.649	1.610	1.573	1.536	1.502	1.470	1. 439	1, 408	1. 379	1.352	1. 326	1.300	1. 275
1,820	1.661	1.622	1.584	1.548	1.513	1.481	1. 449	1, 419	1. 390	1.362	1. 336	1.309	1. 285
1,830	1.674	1.634	1.596	1.559	1.525	1.492	1. 460	1, 429	1. 400	1.373	1. 346	1.319	1. 294
1,340	1.686	1.646	1.608	1.571	1.536	1.503	1. 471	1, 440	1. 410	1.382	1. 356	1.329	1. 304

TABLE E-Continued.

ht in ot.				Tempe	rature (	of exter	mal air	degre	es Fah	renheit	<b>.</b> .		
Height feet.	<b>20°</b>	-10°	00	100	20°	30°	40°	50°	60°	70°	80°	90°	1000
1,350	1.698	1.658	1. 620	1.582	1.547	1.514	1.482	1. 450	1. 420	1.898	1.366	1.889	1.313
1,360	1.710	1.669	1. 631	1.593	1.558	1.524	1.492	1. 461	1. 481	1.403	1.375	1.848	1.323
1,370	1.722	1.681	1. 643	1.605	1.569	1.535	1.503	1. 471	1. 441	1.418	1.385	1.858	1.332
1,380	1.785	1.693	1. 655	1.616	1.581	1.546	1.514	1. 482	1. 451	1.423	1.395	1.868	1.342
1,390	1.747	1.705	1. 666	1.628	1.592	1.567	1.524	1. 492	1. 462	1.433	1.406	1.877	1.351
1,400	1.759	1.717	1.678	1, 639	1.603	1.568	1.585	1.508	1. 472	1.443	1.415	1.387	1.361
1,410	1.771	1.729	1.600	1, 650	1.614	1.579	1.546	1.513	1. 482	1.453	1.425	.897	1.370
1,420	1.783	1.741	1.701	1, 662	1.625	1.590	1.556	1.524	1. 492	1.463	1.485	.406	1.380
1,430	1.796	1.753	1.713	1, 673	1.626	1.601	1.567	1.534	1. 503	1.473	1.444	1.416	1.389
1,440	1.806	1.763	1.724	1, 685	1.647	1.612	1.577	1.545	1. 513	1.483	1.454	1.426	1.399
1, 450	1.820	1.777	1.736	1.696	1.658	1.623	1.588	1.555	1.523	1.493	1.464	1.436	1,438
1, 460	1.832	1.788	1.748	1.707	1.670	1.633	1 599	1.565	1.533	1.503	1.474	1.445	1,418
1, 470	1.844	1.800	1.759	1.719	1.681	1.644	1.609	1.576	1.548	1.518	1.484	1.455	1,427
1, 480	1.857	1.812	1.771	1.730	1.692	1.655	1.620	1.586	1.554	1.523	1.498	1.465	1,437
1, 490	1.869	1.824	1.782	1.742	1.703	1.666	1.630	1.597	1.564	1.533	1.506	1.474	1,446
1,500	1.881	1.836	1.794	1.758	1.714	1.677	1.641	1.607	1.574	1.548	1.513	1, 484	1.456

#### APPENDIX 27.

#### CLASSIFIED LIST OF STATIONS OF THE SIGNAL SERVICE.

#### STATIONS OF THE FIRST ORDER,

Making continuous records by means of self-registering instruments.

#### Washington City.¶

#### STATIONS OF THE SECOND ORDER,

Taking six observations daily, reporting three times a day by telegraph, and monthly by mail.

Boston, Mass.†*¶ Chicago, Ill.†*¶ New York City.†*¶ Philadelphia, Pa.¶ Prescott, Ariz.
Saint Louis, Mo.‡¶
San Francisco, Cal.†2**

El Paso, Tex.

Taking five observations daily, reporting three times a day by telegraph, and monthly by mail

Abilene, Tex.¶ Albany, N. Y.¶ Alpena, Mich. †* Atlanta, Ga. 💵 Atlantic City, N. J.†*
Augusta, Ga.†‡||¶
Paltimore, Md.†*¶ Baltimore, Md. †*¶ Block Island, R. I. †* Bridger, Fort, Wyo. Buffalo, N. Y. †*¶ Cairo, Ill.‡¶ Canby, Fort, Wash.†* Cape Henry, Va.* Cape Mendocino, Cal. Cedar Keys, Fla. †*|| Charleston, S. C.†*||¶ Charlotte, N. C.||¶ Chattanooga, Tenn. ‡¶|| Cheyenne, Wyo.¶ Chincoteague, Va. Cincinnati, Ohio. ‡¶ Cleveland, Ohio. †*¶ Columbus, Ohio.¶ Concordia, Kans. Davenport, Iowa. 19 Denver, Colo.¶ Des Moines, Iowa. Detroit, Mich. †*¶ Dodge City, Kans.¶

Erie, Pa.*¶ Escanaba, Mich. †* Fort Smith, Ark. # 1 Galveston, Tex. †* Grand Haven, Mich. †*¶ Hatteras, N. C. Huron, Ďak. Indianapolis, Ind.¶ Indianola, Tex.*† Jacksonville, Fla. †*¶ Keokuk, Iowa. 19 Key West, Fla,† Kitty Hawk, N. C.* Knoxville, Tenn.‡¶ La Crosse, Wis.‡¶ Lamar, Mo.¶ Leavenworth, Kans. 1 Little Rock, Ark. # Los Angeles, Cal. Louisville, Ky, ‡¶ Lynchburg, Va.¶ Mackinaw City, Mich.†* Macon, Fort. N. C.* Marquette, Mich. †*
Memphis, Tenn. ‡ Milwaukee, Wis. †* Mobile, Ala. †*||¶ Montgomery, Ala. ||¶ Moorhead, Minn.

* Displays cautionary signals.

Eastport, Me. †*

Prints Farmers' Bulletin.

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[†] Rokes observations of temperature of the water in river or harbor at 2 p. m. (75th meridian time), daily.

[†] Takes observations of the stage of water in the river at 2 p. m. (75th meridian time), daily.

Takes cotton-region observation at 6 p. m. (75th meridian time), daily.
Displays cold-wave signal.

#### STATIONS OF THE SECOND ORDER-continued.

Mount Washington, N. H. Myer, Fort, Va.
Nashville, Tenn.; Tenn.; New London, Conn.; New London, Conn.; New Orleans, La.; Norfolk, Va.; Norfolk

Sacramento, Cal.‡
Saint Paul, Minn.‡¶
Saint Vincent, Minn.
Salt Lake City, Utah.
San Diego, Cal.*
Sandusky, Ohio.†*¶
Sandy Hook, N. J.†*
San Luis Obispo, Cal.
Santa Fé, N. Mex.
Savannah, Ga.†*||¶
Shreveport, La.‡||¶
Smithville, N. C.†*
Springfield, Ill.¶
Toledo, Ohio.†*¶
Valentine, Nebr.
Vicksburg, Miss.‡||¶
West Las Animas, Colo.
Winnemucca, Nev.
Yankton Dak.‡¶
Yuma, Ariz.‡

Taking five observations daily, making report once a day by telegraph, and monthly by mail.

#### Qubuque, Iowa.‡¶

Taking five observations daily, and reporting monthly by mail.

Boisé City, Idaho. Frisco, Utah. Greencastle, Ind.¶ Keeler, Cal. New Haven, Conn.†¶

Roseburg, Oreg.

Pike's Peak, Colo. Sanford, Fla.¶ Walla Walla, Wash. Wilmington, N. C.†*||¶

Taking three observations daily, reporting three times a day by telegraph, and monthly by mail.

Apache, Fort, Ariz.
Assinaboine, Fort, Mont.
Bismarck, Dak.
Brownsville, Tex.
Buford, Fort, Dak.
Custer, Fort. Mont.
Deadwood, Dak.
Duluth, Minn.*†
Elliott, Fort, Tex.
Helena, Mont.
Maginnis, Fort, Mont.

Montrose, Colo.
Nantucket, Nantucket Island, Mass.*
Poplar River, Mont.
Port Angeles, Wash.*
San Antonio, Tex.||
Shaw, Fort, Mont.
Still, Fort. Ind. T.
Spokane Falls, Wash.
Stanton, Fort, N. Mex.
Tatoosh Island, Wash.
Totten, Fort, Dak.

Taking three observations daily, and reporting monthly by mail.

Benton, Fort, Mont. Bidwell, Fort, Cal. Davis, Fort, Tex. Grant, Fort. Ariz. Muntrek blayamut. Sitka, Alaska. Sully, Fort, Dak. Thomas, Fort, Ariz.

Mumtrekhlagamut, Koekokvim River,

* Displays cautionary signals.

[†]Takes observations of temperature of water in the river or harbor at 2 p. m. (75th meridian time), daily.

[†] Takes observations of the stage of water in the river at 2 p. m. (75th meridian time), daily.

Takes cotton-region observations at 6 p. m. (75th meridian time), daily. Displays cold-wave signal.

#### STATIONS OF THE THIRD ORDER.

Taking one observation daily (at the hour of sunset), and reporting monthly by mail.

Ashland, Oreg.
Astoria, Oreg.*
Bowie, Fort, Ariz.
Cape Henlopen, Del.*
Cœur d'Alene, Fort, Idaho.
Cottage City, Mass.*
Durango, Colo.
Edgartown, Mass.*
Henrietta, Tex.
Klamath, Fort, Oreg.
Lakeview, Oreg.
Laramie, Fort, Wyo.
Lava, N. Mex.
Linkville, Oreg.
María, Tex.
Maricopa, Ariz.
McDowell, Fort, Ariz.

Narragansett Pier, R. I.
Neah Bay, Wash.
New River Inlet, N. C.*
Ocean City, Md.
Phomix, Ariz.
Pysht, Wash.
Reno, Fort, Ind. T.
San Carlos Agency, Ariz.
Spokane, Fort, Wash.
Supply, Fort, Ind. T.
Verde, Fort, Ariz.
Wash Woods, N. C.
Watrous, N. Mex.
Webster, Dak.
Willox, Ariz.
Yates, Fort, Dak.

#### REPAIR STATIONS,

On the United States military telegraph lines, at which no observations are taken.

Ash Fork, Ariz. Cantonment, Ind. T. Carter, Wyo. Custer Station, Mont. Edinburg, Tex. Galpin, Mont. Glendive, Mont. Lakota, Dak. Parker's, Oreg. Robinson, Fort, Nebr. Santa Maria, Tex.

#### SPECIAL PRINTING STATIONS.

#### Logansport, Ind.¶

#### SPECIAL DISPLAY STATIONS.

Stations receiving orders direct from Washington City.

#### Monroe, Fort, Va.

Stations receiving orders from Washington City (designating section affected) through the observer in charge of the section center.

Mackinaw Section (Chicago, Illinois, center).

Charlevoix, Mich. Cheboygan, Mich. Frankfort, Mich. Petoskey, Mich.

Grand Haven Section (Chicago, Illinois, center).

Ludington, Mich. Manistee, Mich. Montague, Mich. Muskegon, Mich.

Pentwater, Mich. Saint Joseph, Mich. South Haven, Mich.

Milwaukee Section (Milwaukee, Wisconsin, center).

Kenosha, Wis. Manitowoc, Wis. Racine, Wis. Sheboygan, Wis.

Green Bay Section (Milwaukee, Wisconsin, center).

Ahnapee, Wis. Green Bay, Wis. Kewaunce, Wis. Menominee, Mich. Sturgeon Bay, Wis.

Saginaw Bay Section (Detroit, Michigan, center).

Bay City, Mich. East Tawas, Mich. Sand Beach, Mich.

^{*} Displays cautionary signals.

[¶] Displays cold-wave signals.

²⁰ SIG

SPECIAL DISPLAY STATIONS—continued.

Erie Section (Erie, Pennsylvania, center).

Ashtabula, Ohio.

Dunkirk, N. Y.

Oswego Section (Oswego, New York, center).

Cape Vincent, N. Y.

North Fair Haven, N. Y.

Portland Section (Portland, Maine, center).

Bath, Me. Boothbay, Me. Rockland, Me.

Southwest Harbor, Me.

Boston Section (Boston, Massachusetts, center).

Gloucester, Mass. Marblehead, Mass. Newburyport, Mass. Portsmouth, N. H.

Wood's Holl Section (Boston, Massachusetts, center)

Bass River Light, Mass. Highland Light, Mass. Hyannis, Mass.

New Bedford, Mass. Provincetown, Mass. Wood's Holl, Mass.

Newport Section (New London, Connecticut, center).

Bristol, R. I. Fall River, Mass.

Newport, R. I. Stonington; Conn.

Narragansett Section (Narragansett Pier, Rhode Island, center).

Point Judith, R. I.

New Jersey Coast Section (Atlantic City, New Jersey, center).

Barnegat City, N. J.

Savannah Section (Savannah, Georgia, center).

Brunswick, Ga. Port Royal, S. C.

Fort George Island, Fla.

Tybee Island, Ga.

Jacksonville Section (Jacksonville, Florida, center). Fernandina, Fla.

Saint Augustine, Fla.

The following-named stations repeat cautionary signal orders issued to the stations set opposite their respective names:

ottage City, Mass.
lochester, N. Y.
ew York City.
ndianola, Tex.
lobile, Ala.
Yew Haven, Conn.
hicago, Ill.
Key West, Fla.
New Orleans, La.
Vantucket, Mass.

Milwaukee, Wisconsin, notifies, by telegraph, the postmasters at Ashland, Wisconsin, and Houghton, Michigan, of all cautionary signal orders for Duluth, Minnesota, and Marquette, Michigan.

Cleveland, Ohio, notifies, by telegraph, Mr. E. D. Foskett, Lorain, Ohio, of all cautionary signal orders for Cleveland.

Indianola, Tex., notifies Brownsville, Tex., of all cautionary signal orders for Indianola. Pensacola, Fla., notifies Apalachicola, Fla., of all cautionary signal orders for Pensacola.

#### SPECIAL RIVER STATIONS.

Observations of the stage of water in the river are taken at 2 p. m. (75th meridian time). daily.

Cairo, Illinois (center).

Evansville, Ind. Grand Tower, Ill. Johnsonville, Tenn. Mount Carmel, Ill. Paducah, Ky. Vincennes, Ind.

SPECIAL RIVER STATIONS—continued.

Charleston, South Carolina (center).

Mount Holly, N. C.

Chattanooga, Tennessee (center).

Charleston, Tenn. Clinton, Tenn. Decatur, Ala. Kingston, Tenn.

Plattamouth, Nebr.

Leadvale, Tenn. Loudon, Tenn. Strawberry Plains, Tenn.

La Crosse, Wisconsin (center).

Wabasha, Minn.

Leavenworth, Kansas (center).

Saint Joseph, Mo.

Little Rock, Arkansas (center).

Dardanelle, Ark.

Nashville, Tennessee (center).

Burnside, Ky.

Carthage, Tenn.

New Orleans, Louisiana (center).

Girard, La. Monroe, La West Melville, La.

Pittsburg, Pennsylvania (center).

New Geneva, Pa. Oil City, Pa. Parker's Landing, Pa. Rowlesburg, W. Va. Saltsburg, Pa. Warren, Pa. Weston, W. Va. Wheeling, W. Va.

Portland, Oregon (center).

Umatilla, Oreg.

Sacramento, California (center).

Marysville, Cal. Oroville, Cal.

Saint Louis, Missouri (center).

Lexington, Mo. Louisiana, Mo. Peoria, Ill. Warsaw, ¶11.

Shreveport, Louisiana (center).

Fulton, Ark.

Vicksburg, Mississippi (center).

Yazoo City, Miss.

Washington City (center).

Le Claire, Iowa. Muscatine, Iowa.

Alexandria, La. Bayou Sara, La. Camden, Ark. Delhi, La.

Brookville, Pa. Clarion, Pa. Confluence, Pa. Freeport, Pa. Johnstown, Pa. Lock No. 4, Pa. Mahoning, Pa. Marietta, Ohio. Morgantown, W. Va.

Albany, Oreg. Eugene City, Oreg.

Colusa, Cal. Folsom City, Cal.

Beardstown, Ill. Boonville, Mo. Hermann, Mo. Jerome, Mo. Kansas City, Mo.

Coushatta Chute, La.

Arkansas City, Ark. Newport, Ark.

Harper's Ferry, W. Va. Helena, Ark.

#### SPECIAL COTTON-REGION STATIONS AND CENTERS.

One observation made daily at 6 p. m. (75th meridian time).

Wilmington, North Carolina (center).

Cheraw, S. C. Florence, S. C. Goldsborough, N. C. Lumberton, N. C. New Berne, N. C. Raleigh, N. C. Salisbury, N. C. Wadesborough, N. C. Weldon, N. C.

Charleston, South Carolina (center).

Branchville, S. C. Hardeeville, S. C. Jacksonborough, S. C. Kingstree, S. C. Saint George's, S. C. Saint Matthew's, S. C. Yemàsseé, S. C.

Augusta, Georgia (center).

Allendale, S. C. Athens, Ga. Batesburg, S. C. Blackville, S. C. Camak, Ga. Chester, S. C. Columbia, S. C. Greenwood, S. C. Union Point, Ga. Washington, Ga. Waynesborough, Ga.

Savannah, Georgia (center).

Albany, Ga. Allapaha, Ga. Bainbridge, Ga. Eastman, Ga. Fernandina, Fla.*a Fort Gaines, Ga. Jessup, Ga. Live Oak, Fla. Millen, Ga. Quitman, Ga. Smithville, Ga. Thomasville, Ga. Waldo, Fla. a Way Cross, Ga.

Atlanta, Georgia (center).

Anderson, S. C. Cartersville, Ga. Columbus, Ga. Gainesville, Ga. Greenville, S. C. Griffin, Ga.

Birmingham, Ala.

Fort Deposit, Ala.

Greenville, Ala.

Eufaula, Ala.

Marion, Ala.

Macon, Ga. Newnan, Ga. Spartanburg, S. C. Toccoa, Ga. West Point, Ga.

Montgomery, Alabama (center).

Calera, Ala. Opelika, Ala. Pine Apple, Ala. Selma, Ala.

Mobile, Alabama (center).

Aberdeen, Miss. Columbus, Miss. Evergreen, Ala. Livingston, Ala. Macon, Miss. Meridian, Miss. Okolona, Miss. Waynesborough, Miss.

New Orleans, Louisiana (center)

Alexandria, La. Amite City, La. Brookhaven, Miss. Cheneyville, La. Coushatta Chute, La. Hazlehurst, Miss. Lafayette, La. Minden, La. Natchez, Miss. Natchitoches, La. Opelousas, La. Port Gibson, Miss.

^{*} Displays cautionary signals.

a These reports are consolidated at Cedar Keys and telegraphed to Savannah,

#### SPECIAL COTTON-REGION STATIONS AND CENTERS-continued.

#### Galveston, Texas (center).

Austin, Tex.
Belton, Tex.
Brenham, Tex.
Columbia, Tex.
Corsicana, Tex.
Cuero, Tex.
Dallas, Tex.
Hearne, Tex.
Houston, Tex.

Huntsville, Tex.
Longview, Tex.
Luling, Tex.
Orange, Tex.
Sour Lake, Tex.
Tyler, Tex,
Waco, Tex.
Weatherford, Tex.
Weimar, Tex.

#### Vicksburg, Mississippi, (center).

Edwards, Miss. Jackson, Miss. Lake, Miss. Monroe, La.

#### Little Rock, Arkansas (center).

Arkansas City, Ark.
Brinkley, Ark.
Devall's Bluff, Ark.
Forrest City, Ark.
Helena, Ark.
Kensett, Ark.
Magnolia, Ark.
Malvern, Ark.

Monticello, Ark. Newport, Ark. Paris, Tex. Pine Bluff, Ark. Prescott, Ark. Russellville, Ark. Texarkana, Ark.

#### Memphis, Tennessee (center).

Grenada, Miss.
Hernando, Miss.
Holly Springs, Miss.
Milan, Tenn.
Oxford, Miss.
Paris, Tenn.
Scottsborough, Ala.
Tuscumbia, Ala.

Arlington, Tenn.
Batesville, Miss.
Bolivar, Tenn.
Brownsville, Tenn.
Corinth, Miss.
Covington, Tenn.
Decatur, Ala.
Dyersburg, Tenn.
Grand Junction, Tenn.

#### CITIES AT WHICH THE COLD-WAVE SIGNAL IS DISPLAYED.

(Not Signal Service stations.)

Flags furnished by the Signal Service.

Auburn, Ala. Kansas City, Mo. Madison, Wis. Northfield, Minn. Richmond, Va. Wellington, Kans.

### APPENDIX 28.

Monthly and yearly meteorological summaries at stations of the Signal Service, United States
Army.

#### ABILENE, TEX.

[Latitude, 32° 14' N.; longitude, 99° 45' W. Local time, 1.39 slow, Eastern.]

	Pr	**************************************	١.			Tei	pers	tar	e. 			1	Dew 1	oint.			els imi		
l year.										Me	an.								
Months and	Mean.	Maximum.	Minimam.	7 a. m.	3 p. m.	11 р. ш.	Mean.	Maximum.	Minimum.	Maximum.	Minimum.	7 p E.	3 р. ш.	11 р. т.	Mean.	7 a. m.	3 p. m.	11 p. m.	Mean.
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J A B	•				••••			•••							••••				•••
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#### ALBANY, N. Y.

#### [Latitude, 42° 39' N.; longitude 73° 45' W. Local time, 0.05 fast, Eastern.]

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J	29. 996	30, 73	29. 14	19. 2	25, 3	20. 5	21.7	57	-10	31. 2	14.5	11.6	13. 2	18.7	12.8	72	60	74	69
F	29, 909		29.05										10. 3	8. 0	7. 6	77	67	76	73
M .	29, 950	30. 37	29.44	18. 8	28. 5	22. 1	23. 1	49	- 5	82. 4	15.0	11.5			13.3			71	67
Α	29. 946	30. 51	29. 44	40. 3	53. 2	42.4	45.3	85	23		35. 2	31.7	31. 3	32.6	81.9	72	47	69	62
М.	29.905		29. 52								46.7				42.0			68	
J	29.889	80. 20	29. 39	62.7							56. 4				52. 1				
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D	29. 916		29. 04							38. 0					23.0			79	75
Y	29, 922	80. 73	29. 04	41.7	52, 1	43.8	45. 9	97	-10	55. 8	37. 2	34. 4	85. 6	36.0	35. 3	76	56	75	60
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#### ALPENA, MICH.

#### [Latitude, 45° 5' N.; longitude, 83° 30' W. Local time, 0.34 slow, Eastern.]

^{*} This appendix contains data from form 127b for the year ending December 31, 1885. All observa underneath. Large H represents the height of the barometer above sea-level, and small & the height (324)

#### APPENDIX 28.

Monthly and yearly meteorological summaries at stations of the Signal Service, United States Army.

# • ABILENE, TEX. $[H=1,744. \ h=30.]$

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# ALBANY, N. Y. [H=83. h=100.

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### ALPENA, MICH.

#### [H=609. h=52.]

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6.1 4.4 5.1 5.2 7,349 31 W.	5 6 16 21		1 2, 28 1, 16	6 15	9 13 2 19 0 0	1 A.
4.3 5.2 4.3 4.0 6,618 30 SW.		11 3 13 14	5 2. 18 1. 05	13 9	9 10 0 4 0 1 5 8 0 0 0 3	3 M
4.35.03.34.2 6,475 30 NW.		4 11 18 11	8 1.74 1.04	11 13	5 8 0 0 0 3	1 J.
3.34,83.03.7 6,226 29 SE.	1 1 6 27			13 16	2 10 0 0 0 6	0 J.
6.26.13.85.4 0,500 25 W.	2 6 6 18	10 6 27 16	2 7.18 2.26	8 14	9 14 0 0 0 2	0 A.
4. 4 5, 1 2, 9 4, 1 0, 894 32 N.W.	4 5 8 19	5 12 30 8	0 3. 76 2. 75	11 16	8 6 0 0 0 2	3 S.
6.66,55,53,2 5,850 28 E., SW.					5 11 0 7 0 1	
8.58 3 8. 3 R. 4 G, 559 27 E.		10 25 28 10			3 19 0 18 0 0	
8.18.58.28.3 7,589 36 W.						
5, 9 6, 2 5, 1 5, 7 80, 874	25 41 84 153	94 130 308 102	20 34, 71 2, 70	83 149 13	2 157 91 167 0 15 1	4 X.

tions are by eastern time. Appropriate headings show the data contained in the columns immediately of the rain-gauge above ground. (325)

#### APACHE, FORT, ARIZ.

[Latitude, 33° 48' N.; longitude, 109° 57' W. Local time, 2.20 slow, Eastern.]

	Pr	escure	.			Те	mper	atu	re.			1	Dew 1	oint.			kela umi		
year.			-							Me	An.								
Months and	Mean.	Maximum.	Minimum.	7 a. m.	3 p. m.	11 р. т.	Mean.	Maximum.	Minimum.	Maximum.	Minimum.	7 а. ш.	8 p. m.	11 p. m.	Mean.	7 n. m.	8 p. m.	11 p. m.	Mean.
J F M J J S O D	In. 25. 074 25. 006 25. 142 24. 977 24. 970 25. 069 25. 069 25. 066 25. 082 25. 071 25. 104 25. 062	In. 25. 32 25. 29 25. 33 25. 18 25. 08 25. 21 25. 22 25. 19 25. 21 25. 23 25. 38 25. 38	24. 81 24. 85 25. 00 25. 01 24. 93 24. 82 24. 68 24. 72	49. 5 59. 7 59. 6 52. 4 41. 1 37. 2 28. 7	86. 9 82. 6 81. 6 74. 0 60. 6 52. 6	46. 3 52. 0 57. 4 64. 6 72. 5 69. 3 63. 9 53. 8 44. 7 37. 4	47. 1 53. 3 58. 7 64. 9 73. 0 70. 5 66. 0 56. 3 47. 5 39. 6	67 72 81 91 94 101 98 93 87 77 68	34 33 44 50 88 80 22 13	o 47. 7 57. 9 63. 3 69. 9 78. 3 85. 3 87. 6 85. 4 77. 5 64. 5 57. 3		0 16. 2 22. 3 30. 7 29. 5 83. 2 49. 2 49. 2 28. 3 28. 6 23. 9 32. 1	31. 0 36. 3 34. 8 38. 4 45. 0 56. 7 44. 8 35. 8	85. 1 82. 4 86. 7 41. 1 52. 5 57. 6 43. 1 81. 5 83. 1 28. 6	84. 0 32. 4 84. 9 89. 8 50. 7 56. 0 42. 7 81. 7 32. 4 28. 2	82 81 65 57 55 71 81 65 61 72 82	30 32 32 44 28	75 67 68 49 50 44 54 45 66 71	65 49 46 44 52 64 47 44 60 67

#### ASSINABOINE, FORT, MONT.

[Latitude, 48° 32' N.; lengitude, 109° 42' W. Local time, 2.19 slow, Eastern.]

																			_
J	27. 135	27. 68	26. 55	8.9	14. 1	12. 9	12.0	46	-30	21. 4	1.9	- 1.0	3. 3	4.0	2. 1	67	66	70	8
F	27. 108	27.57	26, 52	13, 1	22. 1	17.4	17. 5	51	-17	27.5	8.6	7.3	11.6	10.2	9.7	79	66	74	73
М.	27. 224	27.51	26. 92	33. 7	45. 1	39. 9	39.6	68	15	52.8	29.8	27.6	33. 2	30. 1	30. 3	79	65	69	71
<b>A</b>	27. 122	27.47	26. C1	36. 7	51.9	47.1	45. 2	78	17	58.5	33.8	30, 6	35. 4	34. 4	33. 5	79	57	63	66
М.	27, 094	27, 45	26.74	43. 7	62. 2	55. 5	53. ಗ	83	18	67. 9	38. 9	35. 7	35.8	39. 5	37.0	74	39	57	57
J				1												1			
J	27. 157												47.7					59	58
<b>A</b>	27, 204	27, 46	26. 91	54. 3	72.5	63. 9	63. 6	96	41	78.1	50.7	46.0	50.8	48.6	48.6	75	49	61	62
S											43. 9		41.9						54
Ο	27. 180	27.55	26.78	37.4	56.5	45. 9	46.6	83	19	61.7	82. 3	26. 2	<b>B</b> 3. 3	29. 7	29.7	65	43	54	54
N	27. 025	27. 35	26. 65	33. 1	48.4	39.3	40.3	64	15	52.3	25. 6	23. 2	29. 9	27.8	27.0	67	50	64	60
D	27, 098	27. 59	26, 67	29. 9	37.3	31.8	33.0	68	- 6	43, 8	21.0	18.4	21.8	18.6	19.6	63	55	59	59
Y						!									l		1		
													, , ,						

#### ATLANTA, GA.

[Latitude, 33° 45' N.; longitude, 84° 23' W. Local time, 0.37 slow, Eastern]

	1		- 1		1		1	1			1					- 1	- 1		
J	29, 003	29.42	28, 51	34. 9	45. 1	39. 7	39. 9	64	14	48.4	31.6	27. 1	28. 5	29.6	28. 4	74	56	69	66
F	28. 854	29. 20	28. 27	33. 9	45. 5	39.0	39.5	69	8	48. 1	30. 3	25. 3	28. 1		26. 2				62
М.	28. 922	29. 30	28.62	40.7	54. 2	46. 1	47. 0	69	20	56, 2	38. 1	29. 7	30. 6	30. 9	30.4	66	45	57	
A										70.5	51.5		40.2						
M .	28. 807									74.8	58. 9		52. 9						
J	28. 919	29. 10	28. 70	71.8	82. 3	75. 2	76. 4	90			69. 2		63. 7						
J	28. 892										71.1	68. 3	66. 6	69. 7	68.2	86	56	79	
A	28, 861										69. 7		65. 8					79	75
8	28. 893										63. 8		62. 1						81
0	28, 839										49.0		47.8		48.2	91	60		76
N			28. 51								42. 5		39. 1						
D			28.44										28. 3						61
Y	28. 894	29. 42	28. 27	53. 2	65. 0	57.7	58 .6	91	8	67.0	50.8	46.7	46.1	47.3	46.7	79	54	70	68,
	1	- 1				'											l l	- 1	ł

#### ATLANTIC CITY, N. J.

[Latitude, 39° 22' N.; longitude, 74° 25' W. Local time, 0.03 fast, Eastern.]

#### Monthly and yearly meteorological summary—Continued. APACHE, FORT, ARIZ.

 $[H = 5,050. \lambda = 1.]$ 

		dine						Wiı	ıd.							Prec	ipi- on.		Nt	m	ber	of	day	·8	•		
7 t. m.	8 p. m.	11 p. m.	Mesn.	Total (miles).	Maximum.	Direction.	North.	Northeast.	East.	Southeast.	South.	Southwest.	West.	Northwest.	Calma.	Total.	Max. 24 hours.	Clear.	Fair.	Cloudy.	Rain or snow.	Max. below 32°.	Min. below 82º.	Max. above 90°.	Thunder-storms.	Auroras.	Months and year.
2.8 2.3 1.6 2.3 1.5 0.4 1.3	3.5 3.3 3.3 5.5 2.7 4.6	8. 1 2. 2 1. 8 2. 5 4. 7 3. 5 1. 0 2. 6	1.8 0.9	4, 086 5, 648 5, 081 4, 683 8, 875 4, 219 4, 741 4, 607	31 29 36 38 25 28 32	NE. S. SE. SW. SW. NW. SW.	66 66 00 22 00 33 77 00 11 44 42	20 38 26	22 23 31 21 16 13	9 4 5 16 3 4 4	2 4	23 24 27 13 19 20 23 24		4 0 2 1 0 2 1 2 2 2 2 1	22 16 8 0 2 10	1. 00 2. 05 0. 52 1. 12 0. 82 2. 60 3. 16 0. 44 0. 38 1. 56	1. 07 0. 43 0. 84 0. 48 1. 21 1. 01 0. 24 0. 83 0. 68	17 13 16 20 17 12 11 21 26 15	13 12 10 10 15 15 15 15 9	5	\ 2 6	0 0 0 0	29 23 18 4 0 0 0 7 16 25 118	7 20 9 3 0 0	0 0 0 0 0 8 0 6 6 1 0 0 1 1 17	000000000000000000000000000000000000000	J. F. M. A. M. J. A. S. O. N. D. Y

[H=2,720. h=4.]

3 6. 5 5. 8 6. 2	8,782	54		1	9	9	0	0	40	4	11	19	0. 8	0.42	7	11	13	14	20	29	0	0	0	J
. 8 6, 8 5, 0 6, 5	6,676	47	SW.	4	- 8	12	0	2	34	3	10	11	0. 78	30.39	3	12	13	- 8	16	22	0	0	1	F
14.92.84.3	8, 837	42	NW.	1	11	9	2	3	35	8	16	8	0. 13	0.05	10	15	6	6	0	18	0	0	0	A
0 5, 2 4, 1 4, 4	6,385	42	NW.	2	7	14	3	5	20	12	11	16	0. 3	0. 12	11	13	6	5	0	10	0	0	O	A
. 1 5, 4 4, 4 4, 6	6,752	48	SW.	3	8	U	8	2	18	11	17	5	0.43	0. 21	5	20	2	7	0	3	0	0	1	A
41 144 144 144	100	10		46	de							40			400		46	14.	FV		2.2	24	1.0	J
74.84.04.5	7, 174	41		11	6	5	5	10	19	24	13	0		3 1. 01		13			0	0	4	1	0	J
93, 23, 33, 5	6, 333	39	N.	10	4	14	16	10	12	22	4	1	1.4	0, 64	16	10	5	- 8	0	0	4	1	0	1
03, 52, 03, 4	7,714	51	SW.	5	5	5	5	14	13	39	6	0	0, 1	7 0. 08	17	. 9	4		0	- 0	1	1	0	3
93.32.62.9	7, 129	42	N.	7	4	7	7	11	11	27	19	0	0.00	50.03	18	12	1	- 3	0	14	0	0	0	€
14.24.44.2	7,846	42	W.	3	3	14	- 3	7	28	30	2	0	0, 10	0. 07	11	14	5	5	0	25	0	0	0	2
15.75.35.4				-5			2	4	30	28	12	0		0.21		15				25	.0	0	0	1
															466				++	***	41	4.5	4.1	3

#### ATLANTA, GA. $[H=1, 129. \lambda = 74.]$

CONTRACTOR OF THE PROPERTY OF	COLUMN TOWN		- 1	100				1.7				- 1			F					7		
4. 1 5. 0 4. 2 4. 4 8, 847	37 W.	4	4	25	8	5	12	12	23	0	8.	44	. 72	13	- 8	10	17	1	13	0	3	0 3
4. 24. 73. 74. 2 7, 621	32 NW.	1	4	8	6	4	14	20	27	0				11								
4. 9 5. 2 3. 0 4. 4 7, 494	32 SW.	1 2	3	8	6	5	16	32	27	0	4.	26	. 79	11	13	7	10	0	7	0	3	0 1
5. 1 4. 2 3. 7 4. 3 7. 439	30 NW.	4	4 3 21 8	8	18				20	0	1.	31	), 44	11	12	7	10	0	0	0	1	0 4
5, 1 5, 7 4, 3 5, 0 6, 288	31 E.	2	8	9	11				24	0	6.	12	. 67	10	12	9	14	0	0	0	8	0 1
4, 0 5, 6 8, 5 4, 4 4, 922	27 W.	4 2 2	1		19		15		18	0				11					0	1	7	0 J
2. 8 5. 2 3. 5 3. 8 4, 827	24 N.	3	4	4	10	9	24	20	19	0	4.	02	0.98	11	10	1	11	0		4	15	0 J
4, 4 4, 4 3, 9 4, 2 5, 139		2	9	18	6 10	7	7	14	26	4				13					0	0	9	0 4
6. 0 5. 9 4. 4 5. 4 7, 086	28 E.	3		38	10	4	2	10	15	0	6.	51	1.64	1.8	13	9	12	0	0	0	2	0 8
4. 0 4. 3 2.9 3. 7 7, 251	27 W.	2	- 8	21	10	4	1	23	24	0	3.	94	1.38	16	- 9	6	8	.0	0	0	2	0 (
4. 74. 72. 64. 0 7, 365	26 NW.	0	14	6	10	11	9	18	32	0	3.	98	L 82	11	14	5	12	0	1			0 3
3, 7 3, 7 2, 8 3, 4 8, 204	36 W.	0		- 6	5	3	12	41	26	0	2.	64	1. 25	16	12	.3	8	0	12	0	1	0 I
4. 4 4. 9 3. 5 4. 3 82, 483		25	55	163	119	72	142	234	281													0 3

# ATLANTIC CITY, N. J. [H=13. \(\lambda=87.\)]

4. 7 5. 9 3. 2 4. 6	6, 413	38	S.	9	10	3	4	9	16	18	24	0	4. 27	1, 93	8	19	4	11	7	21	0	0	0	J.
6, 9 5, 3 3, 2 5, 1	6, 421	40	E.	10	17	6	1	1	9	6	33	0	2,00	0.75	7	16	4	9	11	27	0	0	0	F.
5, 16, 14, 55, 2	7, 475	31	N.	4	17	4	9	3	14	10	32	0	0.95	0.29	6	19	6			26				
4.54.22.63.8	5, 281	30	NW.	3	14	13			12	3	23	0	1.68	0.43	13	13	4	6	0	4	0	0	0	A
5, 70, 44, 35, 5	7, 039	31	E.	13		14		14					3, 61	1, 16	4	20	7	15	0	0	0	0	0	M
3. 5 4. 5 2. 1 3. 7	5, 848	33	NE.	3	7	12	10	22	15		12		1.33						0			2		
4 64.51.93.7			NE.			13			15				4.45						0					
3. 8 5. 1 4. 0 4. 3	5, 937	32	NE.	7	14	10	13	21	14	7	5		4.50	1.50	9	18	4	13	0	0		3		
4.44.02.83.7						11							1.59											S.
2, 75, 43, 24, 1				8									2.94											
6.66.55,46.2			N.	-8	1	3					24		6.84											
6. 7 4. 9 2. 8 4. 6			N.	16		2					12		4. 29											
5, 05, 23, 44. 5	76, 151			100	158	100	74	173	140	135	191	23	38, 45	3, 70	103	205	56	116	25	105	1	8	0	X

#### AUGUSTA, GA.

[Latitude, 33° 28' N.; longitude, 81° 54' W. Local time, 0.27 slow, Eastern.]

	Pre	essure.	.					1	Dew p	oint.				tive dity					
l year										Me	an.								
Months and year.	Mean.	Maximum.	Minimum.	7 a. m.	3 p. m.	11 р. ш.	Mean.	Maximum.	Minimum.	Maximum.	Minimum.	7 a. m.	3 p. m.	11 р. ш.	Mean.	7 a. m.	3 p. m.	11 p. m.	Mean.
J F M. J J S O V	In. 30. 037 29. 8×6 29. 945 29. 918 29. 799 29. 850 29. 852 29. 869 29. 824 20. 868 29. 970 29. 891	In. 30, 53 80, 32 30, 38 30, 34 30, 03 30, 10 80, 06 30, 00 80, 09 30, 12 30, 21 30, 48 30, 53	29. 50 29. 55 29. 49 29. 63 29. 61 29. 57 29. 59 29. 27 29. 52 29. 43	73. 6 68. 8 52. 7 43. 8 37. 0	81. 2 69. 4 63. 4 56. 0	76. 3 71. 3 57. 2 49. 9 42. 1	77. 8 80. 7 79. 2 73. 8 59. 8 52. 4 45. 0	74 76 93 92 99 101 99 95 82 85 72	15 26 85 47 58 62 64 52 38 28 28	62. 5 77. 6 83. 0 91. 0 93. 5 92. 4 84. 3 72. 2 66. 3 59. 2	33. 7 39. 6 51. 4 60. 4 68. 5 71. 8 70. 9 66. 6 50. 4 41. 2	30. 5 37. 0 49. 2 58. 7 67. 6 70. 1 69. 6 65. 1 50. 5 41. 8	28. 9 33. 8 43. 9 56. 2 64. 3 67. 0 67. 1 64. 9 50. 4 42. 6 28. 9	70. 4 66. 8 53. 8 45. 6 35. 8	36. 7 47. 6 58. 1 66. 6 69. 3 69. 0 51. 6 43. 3 32. 4	85 84 83 85 86 88 89 92 93	48 43 38 49 49 53 61 54 50 40	78 69 79 82 81 83 86 89 86	66 66 77 77 77 77 77 77 77

#### BALTIMORE, MD.

[Latitude, 39° 18' N.; longitude, 76° 37' W. Local time, 0.06 slow, Eastern.]

J	30. 105	30, 80	29, 45	31. 5	36. 9	33.5	84.0	65	10	42.0	26. 8	21. 6	23.5	23. 3	22. 8	67	60	66	64
F	29. 975	<b>30.46</b>	29. 24	25. 2	32. 3	27. 9	28. 5	50	3	35. 5				17.4	17. 3	70	55	65	
M .	30. 023.	30. 42	29, 58	30. 9	40.3	34. 7	35, 3	68	12	42.6	28. 4	20. 9	20.4	22.2	21. 2	67	46	GU	
Δ	30.009	30. 56	29. 52	47.9	61. 7	53.0	54. 2	81	31	64. 0	45. B	35. 8	37. 8	88, 9	37.5			Ga	.wi
М.	29. 919	30, 16	29. 50	59. 3	68. 8	61. 0	63. 0	82	44	71.2	55. 8	49.4	48. 9	49.9	49. 4	72	54	69	65
J						70. 1	72.6	95	56	82. 3	64. 3	57. 1		59. 1			48	69,	
J	29. 928						79. 6		56	88. 8	71.8	64. 9		67.0					63
A			29. 58							83. 1	67. 4	63.0		64.7					
8	30. 040	30. 33	29.48	61.6	74.4	64. 7	66. 9	86	46	75. 5	59. 2	53. 3		56. 5					6>
0			29.08			53. 6	55. 4	76	38	64.7	48.3	46. 7	46. 3	47.4	46.8	85	CO	F()	75
N	29, 930	30. 34	29, 58	42.0	50.4	44.5	45. 6	73	32	53.0	39.8	34. 9	35. 7	36. 1	35. G	76	60	74	70
D	30.011	30, 75	29. 80	33. 9	42.4	36. 4	37.6	64	15	45. 9	31.0	24. 0	24.8	26.0	24. 9	67	52	66	62
Y	29. 986	30. 80	29.08	49.8	59. 6	52. 4	53. 9	99	3	62.4	46.7	40.7	41.0	42.4	41.4	72	53	70	65
		1									1 )	}						- 1	i

#### BARNEGAT CITY, N. J.

[Latitude, 39° 46' N.; longitude, 74° 6' W. Local time, 0.04 fast, Eastern.]

J	30, 092	30. 80	29, 30	31.7	35, 7	32. 4	33, 3	59	9	41. 3	25. 0	27. 7	28. 9	27. 5	28. 0	85	77	82	81
ř.	29, 965								5	35. 4					21.8			82	80
М.	30. 029	30.48	29. 57						9	41.3	25. 6	23. 8	27. 2	26. 6	25. 9	79	70	83	78
A	30. 012								28	55. 6	39. 4	38. 5	41.5	40.1	40.0	77	70	82	77
М.	29. 946								39		48, 4				49.8			89	85
J	29. 987		29. 43												59. 1			86	79
J	29. 947		29. 69									67. 2		68. 0				90	83
A	29. 958		29.68									66. 1		66, 2				87	
8	30. 047		29.40									58.0		58. 2			75		
0	29. 989		29. 09								50. 5			52. 1					
N	29, 919		29. 55							52.6				42. 1				87,	
D	29. 996		29, 23							45. 5		30. 0		32, 6					
Y	29. 990	30. 80	29. 09	49. 3	54.6	49. 6	51. 2	92	5	58. 5	44. 4	44. 2	46.7	45. 2	45. 4	83	76	85	81
				1					!					' '				_ 1	- 1

#### BENNETT, FORT, DAK.

[Latitude, 44° 43' N.; longitude, 100° 39' W. Local time, 1.42 slow, Eastern.]

J F M A J S O N D	28. 508 28. 452 28. 512 18. 346 28. 347 28. 379 28. 342 28. 425 28. 439 28. 361	28, 89 28, 90 28, 75 28, 68 28, 74 28, 62 28, 71 28, 75 28, 71	28. 18 27. 78 28. 00 27. 62 27. 84	6. 2 25. 2 36. 7 47. 0 56. 7 65. 1 58. 2 49. 9 33. 5	16. 0 41. 8 57. 6 66. 1 74. 6 83. 1 74. 3 71. 4 58. 8	9. 9 31. 1 46. 8 56. 1 64. 7 73. 0 65. 6 58. 6 42. 6	10. 7 32. 7 47. 0 56. 4 65. 3 73. 7 66. 0 45. 0	51 63 78 87 90 102 97 94 83	-27 4 19 25 38 45 45 45 18	87. 4 78. 3 73. 8 62. 2	0. 5 22. 9 35. 7 45. 8 55. 2 63. 4 56. 7 49. 2	1. 4 19. 5 30. 2 40. 7 52. 8 58. 1 52. 9 44. 4 27. 4	8. 5 24. 9 32. 5 43. 0 56. 2 58. 3 55. 1 48. 6 31. 7	4. 1 23. 0 34. 5 44. 5 55. 7 60. 5 56. 7 49. 0 31. 2	4.7	81 79 77 79 86 79 83 83	73 58 44 47 55 45 55 47 39	73 65 67 74 66 74 72 65	64 61 63 71 63 71 67 61
Y	•••••	•••••		•••••	••••		••••		••••	••••			•••••	· • • · ·	••••		···		•••

AUGUSTA, GA. [H=188. h=39.]

Cle (in	ter	line	X68 6).			•	•	Wir	ıd.							Prec	ipi- on.		Nu	mì	)6T	of d	layı	_	
7 a. m.	3 p. m.	11 р. m.	Mean.	Total (miles).	Maximum.	Direction.	North.	Northeast	East.	Southeast	South.	Southwest	West.	Northwest.	Calma.	Total.	Max. 24 hours.	Clear.	Pair.	Cloudy.	Rain or snow.	below	Max. above 90°.	Thunder-storms.	Months and year.
5.54 4.75 4.04 5.5.5 5.5 6.8 7.4 4.04 5.5.5 6.3 7.4 4.04 5.5 6.3 7.4 4.04 6.5 6.5 6.7 7.4 7.4 7.4 7.4 7.4 7.4 7.4 7.4 7.4 7	5 8 7 8 3 0 7	3.4 3.5 2.8 4.5 3.3 3.5 2.2 3.2 3.2	443544433768	3, 905 3, 270 8, 139 2, 902 3, 589 2, 216 2, 256 2, 314 8, 154 8, 126 2, 048 8, 101 84, 015	19 19 25 18 26	SW. W. N. N. SW. S. S. NE. SW. SW.	8 7 5 6 8 5 6 8 8 6 4 64	12 18 88 21 6	2	18 18		7 10	16 8 7 7 8 18 19 25	8 5 5 14 18	10 16 12 6 9 12 18 16 22 24	1. 68 5. 86 2. 80 3. 69 8. 38 2. 78 4. 15 1. 55 2. 14	0. 73 0. 43 1. 97 0. 50 2. 70 1. 68 0. 85 1. 44 0. 47 1. 88	11 14 9 8 7 7 16	12 12 15 18 19 19 11 10 14 18	12 5 2 5	11 7 10 12 10 8	00000000		2 1 5 8 2 1 0	0 J. 0 F. 0 M. 0 J. 0 J. 0 O. 0 O. 0 O. 0 O. 0 V.

## BALTIMORE, MD. [H=45. A=69.]

5.5 5.8 4.4 5.2 5.1 4.8 3.9 4.2 5.8 6.8 4.5 5.7 5.1 5.3 3.7 4.7 6.6 7.7 6.8 7.0 4.4 0.13, 24.6 5.1 0.0 3.1 4.7 6.0 6.3 4.15.5 5.0 5.2 3.4 3 5.4 6.4 4.8 5.5	4, 439 26 4, 876 22 4, 333 31 3, 917 19 4, 354 21 3, 749 24 4, 073 18 3, 531 22 3, 926 24	NW. NW. NW. W. NW. SW. NE. NW.	8 7 15 4 9 13 19	9 13 11 8 21 5 7 8 11 13	4 10 8 7 4 10 8 15 16 16 1 13 5 17 8 15 6 12 6 14	6 0 9 11 9 5 0 1 17 16 12 14 11 15 8 7	10 2 9 3 13 2 5 1 11 2 10 1 12 1 6 1	0 5 4 5 2 1 7 2 1 0 8 3	4. 40 1. 88 1. 60 0. 53 1. 37 0. 56 4. 50 1. 32 6. 31 4. 47	7 5 11 4 10 6 7	18 8 1 11 8 10 17 1 15 5 20 5 1 16 8 1 16 4	5 14 24 2 5 17 9 0 1 2 0 0 8 0 0 0 0 0 1 5 0 0 8 0 0	0 1 0 0 0 1 0 2 4 5 5 4 3 9	0 M. 0 A. 0 M. 0 J. 0 J. 0 A. 0 S.
	3, 926 24 4, 199 23 5, 047 26	S. SW. NW.	23	13 10 12		7 11 11 12 2 12	6 1	3 0 5 4 3 5		7 3 4	16 8 1 14 13 1 19 8	1 0 0	0 2 0 0 0	0 O. 0 N. 0 D.

## BARNEGAT CITY, N. J. $[H=22. \lambda=39.]$

5, 1 5, 8 3, 6 4, 8 12, 191	52	NW.	17			9	10	16	17	24	1	4.3	21	9	16	12	04	0	0		Ŧ.
6, 9 4, 5 3, 4 4, 9 11, 714		SE.	14	9	8	4	6				0	1.4			13					0	F.
4. 9 4. 3 3. 9 4. 4 11, 649	40		16	10	8	3			5	26		0.2			18						
3, 7 4, 5 2, 1 3, 4 10, 491		NW.	7		9	8						0. h			10				1		
5. 2 7. 0 4. 0 5. 4 9, 046 3. 3 4. 5 2. 8 3. 5 8, 553	36	N. NE.	8	20	18	12	28		10		3	0.7			12	15	0			0	Ņ.
3.64.11.33.0 8.437	32	S.	5	7	14	16					1	1. 9					0			0	#.
4. 9 4. 9 3. 2 4. 3 9, 310		NE.	14	6	8	8			14		3			11							A
4.4 2, 7 3.1 3.4 8, 304		NW.	14		14							1.3					0				
4.35.22.04.0 9,598		E.	13		14		14					3. 5									
6. 7 6. 4 4. 7 5. 9 11, 585 6. 0 5. 1 3. 4 4, 8 13, 188		NE.	16		6	2						4.8					17		0		
4. 9 4. 9 3. 2 4. 3 124, 061		LN Est	146		112					192		27. 5									

# BENNETT, FORT, DAK. $[H=1,510. \lambda=18.]$

3, 9, 5, 4, 3, 1, 4, 1, 3, 296, 38, NW. 6, 4, 6, 5, 4, 0, 5, 6, 4, 219, 36, NW. 5, 9, 6, 9, 3, 6, 5, 5, 6, 451, 48, NW. 4, 8, 5, 7, 4, 5, 5, 5, 1, 7, 435, 40, N.	7 8 0 9 1 4 2 23 39 0.14 0.0 12 7 9 11 0 3 3 24 15 0.21 0.0 24 16 3 10 7 2 6 20 5 0.13 0.1 30 9 4 10 13 1 2 8 7 1.84 0.7 23 8 9 16 13 1 4 9 8 3 2.40 0.7	8 6 14 8 10 21 28 0 6 0 F. 0 5 21 5 3 3 28 0 0 0 M. 1 9 15 6 7 0 10 0 2 0 A.
5. 8/4. 8/6. 4/5. 7 6, 321 44 W. 5. 1/3. 6/5. 1/4. 6 6, 596 44 NW. 5. 3.5 6/4. 0/5. 0 5, 446 35 SE. 3. 9/3. 8/3. 5/3. 7 4, 984 29 N. 4. 0. 4. 4/3. 0. 3. 8 4, 798 40 NW.	10 8 9 24 16 6 7 9 1 5 62 1 8 14 9 10 12 23 7 5 13 0 1 5 52 1 1 2 1 8 10 19 15 6 4 10 0 5 87 2 2 2 4 2 17 17 5 7 15 13 1 1 1 4 7 0 6 2 1 1 3 4 5 20 1 1 5 33 1 0 1 4 0 6	0 4 18 8 14 0 0 0 13 2 J. 6 9 18 4 9 0 0 13 9 0 J. 7 11 11 9 11 0 0 4 10 0 A. 8 15 9 6 6 0 0 2 1 2 S.
5.35.74.65.2 5,442 44 N.	20 4 2 29 11 4 6 14 0 0.280.1	

BENTON, FORT, MONT.

		Latitu	ide, 479	50′ 1	ĭ.; lo	ngitu	de, 11	.00 4	o W	. Lo	cal ti	me, 2.2	2 alov	v, Ea	stern	.]			
	Pr	61 <b>UB</b> 80				Ten	npera	tur	3.			1	ow p	omt.				tive dit	
year										Mea	vn.								
Months and year.	Mean.	Maximum.	Minimum.	7 a.m.	3 p.m.	11 р. ш.	Mesn.	Maximum.	Minimum.	Maximum.	Minimum.	7 a. m.	3 p. m.	11 р. ш.	Mean.	7 a. m.	3 p. m.	11 p.m.	Mean.
J	In. 27. 201 27. 175 27. 187 27. 187 27. 196 27. 231 27. 266 27. 27. 27. 27. 27. 27. 27. 27. 27. 27.	In. 27. 76 27. 64 27. 53 27. 53 27. 52 27. 46 27. 42 27. 48 27. 65 27. 48 27. 65	In. 26, 65, 53, 27, 01, 26, 83, 26, 69, 27, 26, 72, 26, 72, 26, 84, 26, 68, 26, 78, 26, 53	8. 8 17. 8 32. 2 36. 2 48. 8 52. 1 56. 0 52. 6 45. 9 85. 4 81. 1 29. 9	9. 19. 1 29. 6 51. 5 55. 0 66. 6 72. 5 76. 8 76. 0 70. 4 62. 1 52. 9 42. 8 56. 3	63. 2 67. 8 65. 5 57. 4 46. 7 89. 8 84. 1	62. 6 66. 9 64. 7 57. 9 48. 1 41. 3 35. 6	71 79 89 98 103 105 93 78 68 78	38 44 41 34 22 16	24. 9 35. 4 56. 8 61. 1 71. 9 78. 7 83. 2 81. 6 63. 7 56. 1 47. 6 61. 3		22. 9 25. 7 37. 7 43. 9 48. 0 44. 2 29. 3 25. 8 23. 2	28.3	52. 8 46. 6 39. 3 84. 6 31. 6	81. 2	68 66 67 74 76 75 73 78 81 77	71 62 42 44 40 55 44 89 36 45 55 58	72 68 63 56 60 71 62 54 53 64 73 75	70
		[Tatit	nda 41	- - 58/ 1	V . 10					ET, C		me, 3.0	) slo	w Ro	etern	<u>'-</u> '			
_	· · · · ·	LAGUU	100, 41	20. ]	4.; 10	ngitu	ue, 12	1	T. M	. 170	CELL	ше, э.с	1 800	W, D4	Proli	٠,	_	_	-
J F M. A M.					72.8		61. 0	58 67 75 76	22 24 30	46. 9 56. 0 66. 4 64. 4	21. 7 29. 2 80. 7 42. 0					• • •			
J A S	25. 418	25. 61	25. 18	51. 0 49. 8 39. 5	86. 2			104	33 88  28	91. 6 79. 0						•••	•••	•	
0 N D	25. 461 25. 321 25. 471	25. 71 25. 78 25. 77	25. 25 24. 94 25. 15	36. 6 84. 7 81. 2	42. 6	88. 4	38. 6	61	23 20 13	73. 8 46. 4 43. 6	33. 5 31. 8 28. 6	30.4					 79 80	 84 83	82 84
¥					· • • • • • • • • • • • • • • • • • • •					••••	• • • • •		••••	• • • • •			•••	• • •	
	·					1	BISM	AR	CK,	DAR						•			
		Latitu	de, 48°	47'	V. ; lo	ngitu	de, 10	000	38' W	. L	cal t	ime, 1.	42 slo	w, E	eteri	1.]			
J M M J S O N	28, 216 28, 173 28, 244 28, 124 28, 112 28, 156 29, 116 28, 100 28, 180 28, 180 28, 180 28, 180 28, 183 28, 161	28. 57	27. 79 27. 59 27. 75 27. 39 27. 67 27. 86 27. 68 27. 68 27. 75 27. 63	- 3. 1 - 1. 5 22. 2 35. 3 45. 3 54. 5 60. 9 53. 8 45. 9 33. 6 27. 0 18. 7 32. 7	77. 1 72. 3 69. 1 53. 9	25. 0 42. 2 53. 6 61. 3 67. 9 60. 8 56. 3 41. 6 30. 0	25. 7 42. 8 54. 0 62. 1 68. 6 62. 3 57. 1 43. 0 30. 8	49 72 83 87 97 92 95 80 51 53	-28 - 9 19 22 34 44 39 32 16	66. 7 74. 0 80. 6	33. 3 43. 1 50. 8 58. 9 52. 3 44. 4 81. 3 24. 4 13. 5	- 4.7 18.9 32.1 41.5 49.9 54.6 49.2 39.6 26.3 23.6	35. 6 47. 9 51. 8 56. 2 50. 4 43. 7 28. 1 28. 1	21. 8 35. 0 45. 9 54. 5 56. 8 51. 4 43. 1 28. 2	21. 2 34. 2 45. 1 52. 1 55. 9 50. 3 42. 1 27. 5 25. 7	87 88 87 85 85 79 75 86 74	83 85 77 60 60 54 50 49 44 41 76 64 62	86 92 86 77 76 79 69 72 61 83 71	88 83 75 74 78 66 62 59
	,	[Latit	ude, 41	° 10′	N.; la					ID, R		me, 0.1	4 fast	, Eas	tern.]				
J M M J S O V	29, 911 29, 980 29, 973 29, 953 29, 954 29, 939 30, 024 30, 003 29, 886 29, 929	80. 41 30. 50 80. 52 80. 28 30. 20 30. 24 30. 38 30. 30 30. 31	29. 47 29. 21 29. 41 29. 66 29. 67 29. 26 29. 25 29. 48 29. 11	22. 1 27. 1 41. 8 49. 8 61. 2 68. 5 67. 1 59. 8 53. 2 46. 0 35. 5	26. 9 33. 4 48. 7 53. 5 67. 2 75. 4 72. 0 64. 7 57. 2 48. 4 38. 1	23. 7 28. 9 43. 2 48. 9 59. 7 68. 0 66. 9 59. 8 53. 1 47. 0 36. 6	24. 2 29. 8 44. 6 50. 7 62. 7 70. 6 68. 7 61. 4 54. 5 47. 1 36. 7	53 53 70 76 77 88 82 78 64 57	7 9 27 38 48 55 53 43 35 31	31. 9 37. 1 53. 1 56. 5 69. 6 77. 0 78. 8 67. 3 59. 6 51. 9 43. 4	23. 0 38. 5 45. 5 56. 3 64. 3 55. 8 49. 1 42. 9 30. 8	16. 2 21. 2 35. 9 45. 8 56. 2 64. 5 62. 3 54. 7 49. 4 41. 9 30. 3	50. 9 43. 1 32. 2	19. 0 23. 4 37. 3 45. 8 55. 2 64. 7 63. 1 54. 9 48. 9	26 19 24 38 40 57 65 63 55 50 43 31	78 78 80 87 84 87 85 83 87 86 81	80 80 78 71 80 75 74 76 74 80 82 79	88 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8	3883

# Monthly and yearly meteorological summaries—Continued. BENTON, FORT, MONT.

 $[H=2,681. \lambda=49.]$ 

_									_	(H:	= 2,	<b>6</b> 81.	^	=1	9. ]							_				_	_
		line oth					V	7in	1.							Prec			Ντ	m	ber	of	day	·e	-		
7 a.m.	8 p. m.	11 р. ш.	Mean.	Total (miles).	Maximum.	Direction.	North.	Northeast.	East.	Southeast.	South.	Southwest.	West	Northwest.	Calma.	Total.	Max. 24 hours.	Clear.	Fuir.	Cloudy.	Rain or snow.	Max. below 320.	Min. below 32°.	Max. altovo 900.	Thunder-storms.	Auroras.	Months and year.
4.44.4.4.7.7.3.4.7.7.3.4.7.7.7.7.7.7.7.7	3.835.54.34.55.6.8	3. 9 4. 9 5. 7 3. 0 4. 2 3. 0 6. 5	6. 3 6. 8 4. 5 5. 2 4. 5 4. 0 5. 2 7. 0	5, 748 4, 878 5, 117 4, 027 4, 178 4, 415 5, 300 3, 659 2, 692 8, 011	37 40 38 46 43 36 40 29 42 33 32 57	SW. W. SW. NE. SW. NE. W. W. W. W.	0 0 2 6 1 3 0 2 2 0 0	15 19 14 16 13 25 16 21 16 10 5 8	1 10 8 6 3 7 4 3	0 0 0 8 10 13 5 2 2 1 0 41	0 0 0 0 3 1 1 4 2 8 1 0 15	82 33 85 16 26 13 24 30 28 29 30 28 324	4 5 15 14 14 11 17 14 25 27 24 17 187	5 3 8 9 7 8 10 5 4 3 7	86 24 18 12 11 13 16 5 6 14 27 88 220	0. 64 0. 48 5. 60 2. 82 1. 81 0. 25 0. 37 0. 65	0. 18 0. 29 0. 19 2. 26 0. 80 0. 66 0. 08 0. 22 0. 61 0. 12	8 2	12 12 9 12 20 20 13 10 17 8 12 13 158	7 4 5 7 6 4 7 10 16	11: 12: 77: 66: 77: 14: 13: 75: 53: 696: 96	00000004	28 21 20 9 3 0 0 0 12 21 23 137	00000357300018	0000036520006	1000100	J. F.M. M. J. A.S.O.N.D.Y.
!		·	!					В				, F		r, (		C.	<u> </u>				'			_!	!_	- !-	_
2.0 3.2 8.1	2.6 3.7 9.0	1. 8 2. 9 7. 0	1.5	2, 298 1, 135 3, 813 2, 250 2, 876 3, 574 3, 363	24 16 20 15 20 24 27	SW. NW. S. NW. (SW) S. W.	19 0 29 5 6 2	2 2 2 4 6 1	0001	4 1 5 8 6 1 4	12 2 83 5 10 42 26	13 13 19 7 7 8	111 3 4 16 26 18 32	30 6 8 16 9	3 2 2 10 8	2. 72 0. 38 0. 09 0. 75 8. 46		7 24 13 13	6 2 6 6 15 8 13	5 1 0 3 21	10 5 5 5 2 5 24 11	0	0 0 1 16 13 21	3 20 1 1 0	000000000000000000000000000000000000000	00000	J. F. M. A. M. J. J. A. S. O. N. D. Y.
		<u> </u>	!	<b>!</b>			<u>.                                    </u>			ISI H=		RC:	-	DA1 = 31		<u> </u>	1	<u>'</u>	١	<u>' '</u>						_!	_
3.4 6.5 6.5 7.4 8.7 8.8 8.8 8.8 8.8 8.8 8.8 8.8 8.8 8.8	4. 3 6. 2 5. 0 6. 0 5. 3 5. 3 7. 0 7. 0	1. 7 4. 4 3. 2 3. 5 5, 1 4. 4 1. 8 0, 2 4. 6	4. 9	4, 969 6, 515 6, 665 6, 522 5, 471 5, 884 4, 465 4, 248 4, 196 4, 760	38 43 29 30 29 32 24	NW. NW. SW. S. E. NW. NW. NW. NW. NW.	13 10 13 23 30 15 22 21 20 24 16 18 225	7 9 17 2 2 9 4	1 3 5 5 14 16 10 11 3 6 19	4 3 7 11 13 10 5 13 13 13 6 111	3 2 0 10 9 13 11 10 9 5 6 10 88	2 4 9 6 1 4 3 2 2 2 0 5 40	8 4 12 1 6 8 5 4 12 4 2 7	30 37 23 17 13 6 20 11 7 19 12 33	30 16 10 7 1 8 3 12 20 18 13	0. 36 0. 18 3. 21 0. 92 2. 39 2. 41 1. 62 0. 14 0. 54 0. 66	0, 10 0, 30 0, 09 1, 44 0, 19 1, 46 0, 47 0, 56 0, 09 0, 42 0, 29 0, 10 1, 46	16 5 10 8 6 8 11 16 14 6	10 18 14 16 19 16 13 11 12 12 20	2 8 6 7 5 7 3 5 12 5	5 3 5 10 10 12 17 8 2 5 8 9 94	9000000412	31 26 31 12 4 0 0 0 17 29 29 179	2 2 0 0 0	0 0 0 0 0 7 11 6 0 0 0 0 2 7	1 1 2 1 1 1 2 0 1 1	J. F. M. A. J. J. A. S. O. N. D. Y.
-		1						1	BL		K I	SL. 27.		D, 1 28.													_
4. 4 5. 2 3. 5 5. 8 4. 0 6. 1 9 4. 2 5. 5	5, 26, 3, 5, 4, 5, 5, 4, 5, 5, 4, 5, 5, 4, 5, 7, 7, 7, 7, 7, 7, 7, 7, 7, 7, 7, 7, 7,	4.7 3.6 3.6 2.5 2.6 6.6	14. 6 5. 2 15. 8 15. 8 15. 8 16. 1 16. 8 16. 8	8, 762 6, 957 10, 961 7, 612 8, 336 8, 819	52 46 44 52 42 29 32 37 44 47 60	N. NE. SW. N. NW. E. NE.	15 16 15 14 5 8 2 8 12 13 16 15 13 16	15 13 7 24 2 12 15 15 14 19 15	5 0 6 1 1 2 5 10 1	7 3 9 18 2 14 19 8 10 4 5	1 12 12 12 11 11 11 11	5 15 24 11 46 39 28 25 18		29 19 16 4 12 3 4 11 7	7 17 0 4 1 0 1 1 3	3. 68 0. 81 2. 65 4. 14 1. 90 0. 86 3. 15 1. 60 5. 81	0. 34 1. 38 1. 15 1. 31 0. 58 1. 67 0. 87 2. 62 1. 82	8 14 9 6 16 13 3	17 20 11 12 11 20 19 12 10 15	7 5 11 5 2 6 2 8 12 10	8 5 10 5 10 12 15	14 8 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0 1 18	0 0 0 0 0	1 0	0 0 0 0 0 0 1 0 0	J. F. M. A. M. J. A. S. O. N. D. Y.

#### BOISÉ CITY, IDAHO.

[Latitude, 43° 37' N.; longitude, 116° 8' W. Local time, 2.44 slow, Eastern.]

	Pr	essure.				Ten	npers	tur	0.			1	Dew 1	oint.				tiv idit	
d year.										Me	en.								
Months and	Mean.	Maximum.	Minimum.	7 a.m.	3 р. т.	11 р. ш.	Mean.	Maximum.	Minimum.	Maximum.	Minimum.	7 a. m,	3 p. m.	11 р. m.	Mean.	7 a. m.	3 p. m.	11 p. m.	Mean.
J F M J J S O N Y	In. 27. 343 27. 247 27. 312 27. 106 27. 109 27. 142 27. 135 27. 230 27. 189	27. 65 27. 60 27. 39 27. 34 27. 35 27. 31 27. 35 27. 42 27. 44 27. 68 27. 67	In. 26, 92 26, 91 27, 06 26, 79 26, 87 26, 93 26, 74 26, 93 26, 70 26, 70 26, 70	0 19. 1 84. 8 36. 0 42. 6 49. 7 54. 2 60. 8 59. 0 51. 5 43. 4 42. 1 81. 8	41. 8 54. 0 60. 8 67. 0 72. 7 84. 2 81. 3 71. 4 61. 4 49. 3 39. 9	54. 7 60. 1 65. 9 76. 6 74. 1 62. 5 52. 9 45. 9 84. 2	52. 7 58. 9 64. 3 73. 9 71. 5 61. 8 52. 6 45. 8 35. 3	59 68 74 87 99 98 96 90 79 62	13 28 28 37 41 51 50 42 32 30	o 33. 8 46. 0 58. 6 65. 2 70. 9 77. 0 88. 1 85. 9 75. 6 66. 3 52. 4 43. 7 63. 6	82. 6 84. 8 40. 9 48. 2 53. 1 59. 7 57. 5 49. 8 41. 2 88. 9 27. 7	81. 4 30. 4 83. 8 43. 3 47. 8 49. 9 46. 6 42. 8 86. 4 29. 6	50. 8 51. 1 49. 0	20. 8 83. 4 34. 7 88. 6 47. 0 51. 9 52. 8 53. 1 47. 3 40. 3 89. 1 81. 1 40. 8	45. 0 50. 2 51. 3 49. 6 44. 5 88. 5 87. 7 81. 3	87 80 72 79 68 64 72 76 81 92	74 70 44 40 46 48 83 83 40 44 65 78	82 61 56 64 62 44 49 50 63 78 89	82 80 62 56 63 48 49 57 61 75 86 65

#### BOSTON, MASS.

[Latitude, 42° 21' N.; longitude, 71° 4' W. Local time, 0.16 fast, Eastern.]

J         29.891         30.66         29.08         23.8         31.1         26.0         27.0         60         -2         36.8         17.9         15.8         10.6         16.3         17.2         71         63         67         67           I*         29.779         30.27         28.87         16.8         24.8         20.4         20.5         52         1         28.7         12.6         8.0         12.9         11.4         10.8         70.6         61         69         64         64         64         11.4         10.8         70.6         66         67         67         71.2         6         8.0         12.9         11.4         10.8         70.6         66         67         64         68.0         12.9         11.4         10.8         70.6         66         67         64         73.7         12.6         8.0         12.9         11.4         10.8         70.6         66         66         64         66         66         64         60.4         60.2         66         66         64         60.4         60.2         40.0         72.2         84         33.1         33.1         33.1         33.6         34.0         33.6							- 1	1	- 1	-		- 1	- 1		- 1	- 1	- 1	- 1	- 4	
M . 29, 841 80, 36 29, 28 24, 8 34, 0 26, 8 27, 9 59 3 36, 7 18, 6 14, 1 19, 5 16, 7 16, 8 69 56 66 64 M . 29, 848 30, 20 29, 40 50, 5 56, 6 80, 7 52, 3 84 35 60, 7 45, 7 41, 4 42, 5 42, 0 42, 0 73, 67 75, 73 J . 29, 810 80, 13 29, 30 63, 2; 78, 6 62, 6 64, 92 45 77, 2 56, 2 51, 3 51, 7 51, 9 51, 6 67 49, 70 62 J .: 29, 810 80, 13 29, 30 63, 2; 78, 6 62, 6 64, 92 45 77, 2 56, 2 51, 3 51, 7 51, 9 51, 6 67 49, 70 62 J .: 29, 810 80, 13 29, 48 64, 4 72, 5 65, 2 67, 4 89 47, 75, 1 60, 6 57, 8 58, 9 50, 6 58, 8 76, 76, 76, 76, 76, 76, 76, 76, 76, 76,	J									- 2									67	67
A. 29, 841 80, 42 29, 67 43, 1 51, 7 44, 1 40, 3 82 27 56, 4 38, 4 33, 1 33, 6 34, 0 33, 6 69 54 69 64 M . 29, 856 30, 20 29, 40 50, 5 55, 6 50, 7 52, 3 84 35 60, 7 45, 7 44, 4 42, 3 41, 4 42, 3 42, 0 42, 0 78, 67 75 71 J . 29, 810 80, 13, 29, 30 63, 2 78, 6 62, 5 66, 4 92 45 77, 2 56, 2 51, 3 51, 7 51, 9 51, 6 67 49 70 62 J . 29, 816 80, 10 29, 848 69, 2 78, 1 68, 7 71, 3 93 51 80, 3 63, 4 59, 6 60, 4 60, 4 60, 1 73 60, 76 70 A . 29, 832 80, 13, 29, 48 64, 4 72, 5 65, 2 67, 4 89 47, 75, 1 60, 6 57, 8 68, 9 50, 6 58, 8 80 64 83 76 8 . 29, 889 30, 26 29, 05 55, 7 65, 7 57, 8 109, 6 84 39 60, 2 51, 1 48, 7 49, 5 50, 3 49, 5 77, 58 78, 71 (0 . 29, 884 80, 22 29, 98, 47, 8 80, 1 48, 4 51, 1 73 33 50, 1 44, 2 43, 1 45, 4 42, 9 43, 8 85, 70, 79, 78 N . 29, 764 80, 27 29, 34 41, 2 47, 3 42, 8 43, 8 69 23, 50, 8 37, 2 34, 1 36, 8 36, 0 35, 6 76, 70, 78, 75 75, 78, 78, 79, 79, 78, 79, 79, 78, 79, 79, 79, 79, 79, 79, 79, 79, 79, 79	Jr																		039	67
M	М.																			64
J.         29, 810         80, 13         29, 30         63, 2         78, 6         62, 5         66, 4         92         45         77, 2         56, 2         51, 3         51, 7         51, 9         51, 6         67, 49         70         62           J.         29, 816         30, 10         29, 48         69, 2         78, 1         68, 7         71, 3         93         63, 3         63, 4         50, 6         60, 4         60, 4         60, 4         60, 1         60, 6         57, 8         89, 9         60, 6         58, 8         80, 6         58, 8         80, 64         83         76, 8           S.         20, 884         80, 22         29, 05         55, 7         65, 7         57, 3         09, 6         84         39         60, 2         51, 1         48, 7         49, 5         50, 3         49, 5         50, 3         49, 5         77, 5         8         8, 9         40, 6         58, 8         80, 6         88, 8         60, 2         51, 1         48, 7         49, 1         48, 7         49, 1         48, 7         49, 1         48, 7         49, 1         48, 7         49, 1         48, 7         49, 1         48, 7         49, 1         48, 7         49, 1 <th>Δ</th> <th>29, 841</th> <th>30.42</th> <th><b>29</b>. 07</th> <th>43. 1</th> <th>51. 7</th> <th>44. 1</th> <th>46.3</th> <th>82</th> <th>27</th> <th>56.4</th> <th>38.4</th> <th>33. 1</th> <th>33. 6</th> <th>34.0</th> <th>33. 6</th> <th>69</th> <th>54</th> <th>69</th> <th>64</th>	Δ	29, 841	30.42	<b>29</b> . 07	43. 1	51. 7	44. 1	46.3	82	27	56.4	38.4	33. 1	33. 6	34.0	33. 6	69	54	69	64
J.:         29,816         30, 10         29,48         60,2         76,1         68,7         71,3         93         51         80,3         63,4         59,6         60,4         60,4         60,4         60,1         73         60,6         58,8         95,6         64,8         73         76,1         60,6         57,8         89,9         50,6         68,8         80,64         83         76         70,1         80,0         22,1         80,0         80,2         80,0         80,2         80,0         81,0         80,0         81,0         80,0         81,0         80,0         81,0         80,0         81,0         81,0         80,0         81,0         81,0         81,0         81,0         81,0         80,0         81,0         81,0         81,0         81,0         81,0         81,0         81,0         81,0         81,0         81,0         81,0         81,0         81,0         81,0         81,0         81,0         81,0         81,0         81,0         81,0         81,0         81,0         81,0         81,0         81,0         81,0         81,0         81,0         81,0         81,0         81,0         81,0         81,0         81,0         81,0         81,0 </th <th>М.</th> <th></th> <th></th> <th></th> <th></th> <th></th> <th></th> <th></th> <th></th> <th></th> <th>60.7</th> <th>45.7</th> <th>41.4</th> <th>42, 5</th> <th>42,0</th> <th>42.0</th> <th>73</th> <th>67</th> <th>75</th> <th>71</th>	М.										60.7	45.7	41.4	42, 5	42,0	42.0	73	67	75	71
A 29, 832 80, 13 29, 48 64, 4 72.5 65.2 67.4 89 47 75.1 66, 6 57.8 68.9 50, 6 58.8 50 64 83 76 58 2 98 50, 6 58.8 50 64 83 76 58 2 98 50 58 58 59 50 58 59 59 59 59 59 59 59 59 59 59 59 59 59	J																			
8 29. 889 30. 26 29. 05 55. 7 65. 7 67. 3 69. 6 84 39 60. 2 51. 1 48. 7 49. 5 50. 3 49. 5 77 58 78 71 O 29. 884 80. 22 29. 08 47. 8 86. 1 48. 4 51. 1 73 33 50. 1 44. 2 43. 1 45. 4 42. 9 43. 8 85 70 79 78 N 29. 764 80. 27 29. 34 41. 2 47. 3 42. 8 43. 8 69 23 50. 8 37. 2 34. 1 36. 8 36. 0 35. 6 76 70 78 75 D 20. 805 80. 56 28. 95 30. 3 38. 2 81. 8 32. 8 62 12 40. 7 24. 6 21. 7 23. 7 22. 9 22. 8 70 62 69 67	J .:										80, 3	63. 4	59, 6	60.4	60.4	60. 1	73	60	76	70)
O 29.864 80.22 29.08 47.8 80.1 48.4 51.1 73 33 50.1 44.2 43.1 45.4 42.9 43.8 85 70 79 78 78 79.29.764 30.27 29.34 41.2 47.3 42.8 43.8 60 23 50.8 37.2 34.1 36.8 36.0 35.6 76 70 78 75 75 75 75 75 75 75 75 75 75 75 75 75	A										75, 1	60, 6								
N 29, 764 80, 27 29, 34 41, 2 47, 3 42, 8 43, 8 69 23 50, 8 37, 2 34, 1 36, 8 36, 0 35, 6 76 70 78 75 1) 20, 805 80, 56 28, 95 30, 3 36, 2 81, 8 32, 8 62 12 40, 7 24, 6 21, 7 23, 7 22, 9 22, 8 70 62 69 67	8	29. 889	30. 26	29.05	55.7	65.7	57. 8	59. 6	84	39	60. 2	51.1	48.7	49. 5	50.3	49. 5	77	58	78	71
D 20. 805 80. 56 28. 95 30. 3 30. 2 81. 8 82. 8 62 12 40. 7 24. 6 21. 7 23. 7 22. 9 22. 8 70 62 69 67	0	29. 884	80. 22	29.08	47.8	86. 1	49. 4	51.1	73	33	59, 1	44.2	43.1	45. 4	42.9	43. 8	85	70	79	78
	N										50.8	37. 2	34.1	36, 8	36, 0	35. 6	76	70	78	75
Y. 20.834 30.66 28.87 44.0 52.1 45.5 47.2 93 - 2 56.0 39.2 35.7 37.9 37.0 36.9 73 61 73 69	1)	20, 805	80. 56	28, 95	30. 3	36. 2	81.8	32.8	62	12	40.7	24. 6	21.7	23.7	22, 9	22. 8	70	62	69	67
	Y.	29. 834	30. 66	28. 87	44.0	52. 1	45. 5	47. 2	93	- 2	56, 0	39. 2	35, 7	37.9	37.0	36. 9	73	61	73	69
	- 1		.			1							400	1	1 - 47					

# BRIDGER, FORT, WYO. [Latitude, 41° 28' N.; longitude 110° 80' W. Local time, 2.22 slow, Eastern.]

M M J J 8	23, 681 23, 564	23. 77 23. 44 23. 78 23. 23	48. 2 71. 0 41. 8 4. 6 33. 9 57. 5	57. 0 .58. 7 49. 6 51. 8	46 4 80 10 83 21 79 23 80 23 86 87 86 33 79 81	84. 4 18. 5 44. 4 20. 7 53. 6 81. 0 60. 7 32. 6 68. 9 87. 6 78. 2 45. 6 74. 9 45. 5 68. 8 88. 4	39. 7 43. 6 82. 2 35. 6	43. 6 42. 8 35. 6 34. 5	74 42 72 38	63 60 61 57
A	28, 681 23, 564 23, 598 23, 468 28, 505	23. 77 23. 44 23. 78 23. 23 23. 76 23. 35 23. 75 22. 92 23. 79 23. 06	48. 2 71. 0 4 41. 8 64. 6 33. 9 57. 5	57. 0 .58. 7 49. 6 51. 8 40. 9 44. 1 30. 4 32. 1 122. 8 25. 4	86 33 79 81 76 16 62 8 48 - 3	68. 8 88. 4 61. 1 29. 8 47. 2 19. 6 34. 8 14. 6	82. 2 35. 6 25. 2 26. 8 19. 8 26. 7	35. 6 34. 5 24. 8 25. 6 24. 3 23. 4 18. 9 18. 8	72 38 72 38 82 58 80 68	61 57 54 53 77 73 85 78

#### BROWNSVILLE, TEX.

#### [Latitude, 25° 53' N.; longitude, 97° 26' W. Local time, 1.30 slow, Eastern.]

### Monthly and yearly meteorological summaries-Continued. BOISÉ CITY, IDAHO. [H=2,750. h=32.]

		dine						Wi		<i>II</i> =	2,	50.	n:	= 32	s. j	Prec			N	ıml	ber	of	da	ys.	_	+
7 a. m.	3 p. m.	m.		Total (miles).	Maximum.	Direction.	North.	Northeast.	East.	Southeast.	South.	Southwest.	West.	Northwest.	Calms.	Total,	Max, 24 hours.	Clear.	Fair.	Cloudy.	Rain or snow.	Max. below 320.	Min. below 32º.	Max. above 900.	Thunder-storms.	Auroras.
1.8	4. 3. 1. 2. 7. 6.	0 5, 7 0 6, 4 1 1, 7 3 3, 8 3 3, 1 5 2, 2 5 2, 2 6 4, 5 7 8 4, 6 8 3, 7	7 2.3 8 3.1 2 3.8 1 2.4 2 1.8 2 2.3 0 7.1 5 5.5	3, 0 3, 2 3, 0 3, 0 2, 4 2, 5 2, 1 4, 1 2, 7	KI 27 10 24 15 36 13 25 14 28 90 25 55 26 15 28	NW. NW. NW. S. E. NW. SW, SE,	9 4 5 7 5 5 6 11 8 8 6 4 7 78	10 6 6 2 1 2	7	22 16 31 16 17 22 14 10 28 30 38 29 273	2 2 1 2 1 1 4 2 2 4 0 3 24	1 3 7 1 1 1 1 3 1 0 1 0 20	5 6 8 4 8	21 50 18 36 27 80 28 34 19 18 16 24 301	14 10 7 9 19 10 13 15 12 15 9 17	1. 08 0, 23 0, 09 0. 39 0. 58 2. 07	0, 52 0, 03 0, 06 1, 30 0, 38 0, 10 0, 06 0, 33 0, 34 0, 38 0, 19	9 5 23 19 14 13 20 22 20 18 3 8 174	7 10 13 12 9 8 9 12 12 14	4 5 2 1 1 1 15 9	3 11 9 4 4 3 6 17	0 0 0 0 0 0 4	0 0 0	0 0 0 3 12 10 0 0 0	0 0 1 2 9 10 5 1 0 0 0 0 2 8	0 J 0 F 0 M 0 J 0 J 0 J 0 S 0 O 0 N
			1							BO:			M.													
136 141 151 121 141 141	5. 4 4. 6 5. 3 4. 6 5. 3 5. 1 6. 8 5. 1	4. 9 3. 8 4. 7 4. 4 2. 5 3. 2. 9 3. 6 5. 7 5. 5 4. 2	5.2 4.4 4.7 4.0 5.2 3.8 5.1 3.2 4.0 5.6 4.0	10, 70 9, 24 10, 27 9, 32 7, 81 8, 93 5, 91 7, 43 6, 97 7, 30 9, 33 10, 85 104, 20	9 42 4 54 7 89 3 50 1 44 9 34 1 24 1 33 7 37 5 40 2 46 6 48	S. E. W. N. N. E. S. N. E. NE. W.	8 7 13 12 10 9 10 12 13 11 15 20 140		2 6 2 12 28 3 13 11 7 16 7 1 108	1 3 0 2 7 3 6 11 5 8 3 1 50		22 5 8 9 11 26 18 20 13 11 14 13		17 7 14 11 17 10 10 11 20 58	3 4	5. 33 3. 00 1. 15 3. 30 4. 26 3. 70 1. 44 7. 64 1. 70 5. 71 5. 71 2. 09 (5. 10	1. 74 0. 41 1. 26 0. 99 1. 67 0. 43 2. 53 0. 88 1. 91 1. 96 0. 47	8 15 11 15 13 3 14 14 9 8	11 15 21 12 12 11	6 7 7 0 4 3 7 4 5	12 7 8 12 7 9 12	100000007	26 28 28 4 0 0 0 0 0 8 26 20	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0 0 0 0 2 3 4	0 J 0 0 M 0 0 J 0 0 J 0 0 S 0 0 N 1 1 2 Y
							<del></del>	В	RII [E	GE l=			RT h=		YO	). 				<u>.</u>				_:		-,
	5. 7 4. 6 3. 5 6. 6	2.8 1.9 1.4 3.0	4. 0 2. 9 2. 4 4. 2 3. 8	3, 43 5, 28 5, 62 2, 94 6,04	3 32 2 30 5 41 6 36 7 44	SW. SW. SW. SW. W.	3 0 3 1 4	2 11 5 6 2	6 3 1 5 1		13 8 9 1 7	37 46 52 25 38	10 16 15 19 21		15 2 0 2	0. 27 1. 49	) 51 ), 45 ), 18 ), 29	13 19 20	7 10 6		3 11 4 17 22 10 10 5 3 3 7	0 0 0 2	0 2 18	0 0 0 0 0	2 (2 (1 (0 (0 (0 (0 (0 (0 (0 (0 (0 (0 (0 (0 (0	J. F. M. J. J. AS. OND. Y
									BRO	)W: [ <i>П</i> :			LE.		EX.	•										
_			5. 9 6. 0 7. 6 6. 2 8. 6 2. 9 4. 0 5. 1 4. 3 4. 1	5, 31 5, 74	8 26	N. N. S.	28 33	3	7 2 19 11 19	5 4 10	10 25 16	2 1 1 2 3 0 3 4 1 8	6 2 0	22 7	5	3, 87,1 2, 52 1 1, 54 (	l. 13	5 7	15 9 12	11 12	11	000	n	0 0	0 0	0 J 0 F 0 N 0 A

BUFFALO, N. Y. [Latitude, 42° 58' N.; longitude, 78° 59' W. Local time, 0.15 alow, Eastern.]

		Latit	ude, 42	50 PS/	N.; k	ngitu	ide, 78	P 5	B' W	. Lo	oal tir	ne, 0.1	alow	, Ea	stern.	1			
	Pr	eaure				Te	mpers	tur	ю.			1	Dew I	oint.		þ	Rela umi	ti ve dit y	) 7.
Months and year.		B.	B.					B.	ei ei	Me									
Months	Mean.	Maximum	Minimum	7 a. m.	3 p. m.	11 p. m.	Moan.	Maximum	Minimum	Maximu	Minimum	7 a. m.	3 p. m.	11 p. m.	Mosn.	7 P. B.	8 p. B.	11 р. ш.	Mean.
J F M J SO D Y	In. 29. 285 29. 210 20. 265 29. 286 29. 200 29. 265 29. 231 29. 233 29. 307 29. 242 29. 176 29. 221 29. 243	In. 29. 99 29. 76 29. 74 29. 48 29. 55 29. 60 29. 60 29. 60 29. 94	28. 74 28. 81 28. 71 28. 82 28. 38	0 19. 1 10. 1 10. 6 87. 6 50. 7 58. 8 66. 4 61. 6 56. 1 46. 3 89. 0 28. 7	0 21. 8 17. 1 22. 7 48. 5 56. 7 64. 0 73. 8 69. 8 65. 4 53. 8 42. 4 81. 7 46. 8	52. 0 60. 3 68. 4 63. 2 58. 5 47. 5 40. 0 29. 7	0 20. 4 18. 8 19. 7 89. 9 53. 1 00. 9 69. 5 64. 7 60. 0 49. 2 40. 5 80. 0 43. 5	80 83 83 83 83 83 83 83 83 83 83 83 83 83	0 - 5 -13 - 4 20 30 44 48 49 41 29 28 5 -13	0 27. 9 28. 6 28. 1 48. 7 61. 7 68. 0 77. 5 68. 0 87. 8 46. 0 87. 8	0 14.0 5.6 12.7 32.7 40.0 53.7 62.5 58.2 52.3 43.8 86.2 24.4	0 16. 5 6. 9 12. 0 81. 9 45. 6 58. 4 61. 6 58. 7 51. 1 41. 9 25. 5	0 18. 0 12. 8 17. 8 34. 5 56. 2 65. 7 61. 1 53. 9 44. 9 86. 5 27. 1 89. 7	47. 1 55. 2 64. 2 59. 1 53. 0 43. 4 25. 8	47. 1 54. 9 63. 8 59. 6 52. 7 43. 4 35. 7	82 80 84 84 85 90 84 85 86 88	85 81 73 76 77 76 68 78 83 78	86 82 77 84 84 87 82 85 86 84 85 84	87 84 87 81 83 84 76 81 81 81 82 83
				<u> </u>	<u> </u>	BU	FOR	<u>l</u> D, 1	FOR	T, D	AK.				! 			!	
		[Lati	tude,	180 N	; lon	gitud	e, 1089	56	w.	Loc	al tim	e, 1.56	alow,	East	ærn.]	_		_	
J M J SO DV	27. 979 27. 947 28. 023 27. 909 27. 884 27. 924 27. 887 27. 984 27. 897 27. 959 27. 877 27. 915 27. 932	28, 54 28, 42 28, 41 28, 28 28, 27 28, 34 28, 27 28, 27 28, 27 28, 26 28, 22 28, 34 28, 54	27. 87 27. 40 27. 63 27. 88 27. 57 27. 16 27. 43 27. 43 27. 44 27. 50 27. 42 27. 42	- 5. 2 0. 1 24. 1 85. 3 44. 0 53. 9 58. 7 53. 2 43. 7 32. 4 29. 3 19. 9 32. 4	4. 5 10. 2 83. 3 53. 1 65. 1 71. 2 77. 8 72. 2 68. 2 54. 8 39. 7 29. 7 48. 3	0. 7 3. 4 28. 6 42. 1 53. 4 60. 4 66. 9 60. 3 54. 5 41. 8 32. 9 21. 9 38. 9	0.0 4.6 28.7 43.5 54.2 61.8 67.8 61.9 55.5 43.0 23.8 39.9	45 46 58 75 84 91 96 90 78 58 59 96	-46 -32 3 19 20 36 46 40 30 15 12 -10 -46	11. 3- 15. 2- 89. 1 57. 7 70. 2 76. 5 82. 8 76. 1 72. 0 57. 8 42. 4 33. 6 52. 9	-13. 1 - 6. 0 19. 9 82. 8 41. 6 50. 5 57. 4 51. 3 41. 5 29. 4 28. 8	-10. 8 - 5. 2 19. 8 29. 6 37. 9 50. 5 54. 1 49. 1 37. 8 27. 1 27. 7 17. 8 28. 0	2.8-2.0-23.7 32.0 37.6 52.8 55.7 51.7 41.3 31.6 32.5 22.7 31.7	- 5. 3 - 2. 5 - 23. 2 33. 0 37. 9 51. 8 56. 0 50. 9 40. 8 30. 3 29. 6 18. 9 30. 4	- 6. 3 - 1. 9 22. 2 81. 5 37. 8 51. 7 55. 3 50. 6 40. 0 29. 7 29. 9 19. 8 30. 0	75 78 83 81 80 89 85 87 81 81 93 92 84	71 71 68 49 39 54 49 50 41 44 77 77	75 76 80 72 58 75 70 73 62 66 88 88 74	74 75 77 67 59 72 68 70 61 64 86 86
		[Latit	ude, 87	o 0 1	N.; lo	ngitu			0, II V W		cal tir	ne, 0.5	o alow	r, Eas	tern.	]			
J F M J J S O N	29. 818 29. 681 29. 757 29. 644 29. 578 29. 636 29. 616 29. 656 29. 649 29. 649 29. 765 29. 676	30. 83 30. 11 30. 16 30. 02 29. 80 29. 86 29. 81 29. 88 29. 97 29. 83 30. 24 30. 33	29, 02 29, 17 29, 89 29, 18 29, 18 29, 43 29, 50 29, 35 29, 27 29, 21 29, 02 29, 02	25. 9 27. 0 36. 7 53. 7 60. 7 69. 6 75. 0 70. 8 64. 0 49. 8 43. 4 34. 1 50. 9	88. 8 36. 4 48. 8 66. 2 71. 9 81. 0 80. 5 83. 6 75. 4 63. 4 54. 8 44. 2 62. 1	80.8 82.2 42.6 59.3 64.1 73.0 78.5 75.2 68.6 54.5 47.8 38.7 55.4	29. 8 31. 9 42. 5 59. 7 65. 6 74. 5 80. 0 76. 5 69. 3 55. 9 48. 7 39. 0 56. 1	61 67 75 81 89 92 96 95 78 76 63	- 4 1 16 34 40 58 62 54 51 39 28 14 - 4	37. 9 40. 5 51. 3 69. 5 74. 1 82. 4 87. 6 84. 6 76. 5 64. 5 64. 3	22. 1 23. 6 34. 9 51. 6 58. 3 66. 6 72. 9 69. 4 62. 8 48. 6 40. 1 30. 4 48. 4	20. 7 18. 9 29. 6 44. 2 53. 8 63. 6 70. 0 65. 5 45. 8 86. 5 26. 7 44. 6	24. 2 23. 9 32. 2 46. 5 52. 2 66. 4 70. 1 67. 3 61. 4 45. 6 86. 8 27. 9 46. 2	23. 4 21. 3 81. 3 54. 5 65. 9 72. 0 67. 6 62. 4 48. 0 27. 8 46. 6	22. 8 21. 6 31. 0 45. 7 53. 5 65. 3 70. 7 66. 8 61. 1 46. 5 37. 1 27. 5 45. 8	75	71 51 52 52 59 64 54 54 55 58	76 65 63 72 79 81 78 81 79 71 66 78	76 66 65 68 74 75 77 73 67 66 70
	1	[Latite	ade, 46	o 16/ 1	N.; lo		NBY, de, 12			WA Loc		ne, 8.16	alow	, Eas	tern.]	1			
J F M J J SO	29. 879 29. 891 29. 989 29. 877 29. 799 29. 853 20. 840 29. 749 29. 770	30. 18 30. 32 30. 42 80. 16 30. 03 30. 07 30. 06 29, 99 29. 99 30. 03	29. 83 29. 51 29. 66 29. 55 29. 53 29. 54 29. 50 29. 59 29. 59	39. 9 44. 7 47. 6 46. 4 50. 4 53. 5 57. 8 55. 9 56. 8	42. 9 46. 8 51. 2 51. 8 54. 8 58. 3 60. 2 60. 6 58. 0	42. 2 45. 5 49. 7 48. 4 52. 6 55. 7 60. 4 57. 4 58. 2	41. 7 45. 7 49. 5 48. 9 52. 6 55. 8 60. 4 57. 8 58. 5 55. 1	58 58 70 75 66 75 70 70	31 35 38 37 44 46 51 50 49	45. 5 49. 1 54. 8 54. 0 57. 8 60. 1 65. 7 62. 6 60. 6	88. 1 41. 8 44. 7 44. 5 48. 5 51. 7 55. 9 53. 8 54. 0 51. 0	86. 8 42. 6 43. 8 48. 1 47. 5 51. 3 54. 0 53. 5 54. 4 49. 9	39. 6 44. 0 45. 7 45. 0 50. 3 52. 8 56. 5 56. 2 57. 3 53. 5	89. 0 43. 2 44. 5 44. 2 48. 4 51. 5 54. 3 55. 5 51. 4	88. 5 43. 3 44. 7 44. 1 48. 7 51. 9 54. 7 55. 7	89 98 88 89 90 92 88 92 92	89 91 83 80 85 87 87 87 86	89 92 84 86 86 86 81 89	89 92 85 85 87 87 83 90 91 84

BUFFALO, N. Y. [H=690, h=108]

		ine						Wi	nd.							Pred tati	oipi- on.		N	aml	ber	of	day	78		
4	8 p. B.	Nor   Nor														Total.	Max. 24 hours.	Clear.	Fair.	Cloudy.	Rain or snow.	Max. below 32°.	Min. below 32°.	Thurder etches	/ Auroras.	Months and year.
6.37 5.85 5.46 4.45 7.36 6.56 8.28 7.98	17.3 17.3 1.5 1.5 1.6 1.6	6.3 6.0 6.0 6.3 8.3 8.1 8.2 7.9	6.65 5.55 4.14 6.88 2.88	7, 772 10, 110 7, 423 6, 216 7, 220 6, 385 6, 242 6, 869	56 44 33 42 32 43 41 37	8W. 8W. 8W. 8W. 8W. 8W. 8W. 8W.	1 1 5 6 2 3 8 13 3 9 7 0 5 8	6 11 10 12 12 3 6 13 11 13 12 10 119	10 2 11 9 2	12 5 5	13 17 19 12 14 14 16 18 12	25 81 82 41 89 18 24 12 12	28 9 24 10 6 10 11 14 15 18 28 38 211	3 3 3 3 2 7 5 7 8 5 8 5 8 1 5 0	0	3. 80 6. 39 3. 63 10. 63 4. 88 6. 19 2. 66 4. 51	0. 76 0. 40 1. 71 1. 30 3. 28 1. 43 2. 66 1. 57 1. 59	5 4 8 6 13 12 4 10 7 0	15 10 15 9 16 16 14 10 8	12 10 8 3 11 6 14 22 21	17 14 13 17 11 17 20	00000	28 29 19 0 0 0 2 12. 26 145	000000000	8 0 4 1 2 0 0 0	J. F. M. J. J. A. S. O. N. D. Y.

#### BUFORD, FORT, DAK.

 $[H=1,930. \ h=1.]$ 

. 35. 95. 25. 1 5, 5	9 34	w.	8	5	4	3	12	10	30	17	4	0.	64 0, 36	7	14	10 10 27	31	0	0 2	J.
0 5, 9 4, 8 5, 2 6, 4	13 50	W.	5	11	6	2	5	.9	28	14	4	0.	44 0, 19	10	9	9 8 20	28	0	0 1	F
27.36.36.6 8,0	92 58	W.	10	12	13	1	6	.5	29	16	1	0.	03 0. 01	0	19	12 3 6	30	0	0 0	M
5 6. 1 5. 9 6. 2 8, 4	6 50	W.	10	15	4	10			12	24	0	1.	71 0. 45	5	14	11 12 0	13	0	0 0	A
5 6. 8 4. 4 5. 6 7, 1	50 32	NW.	15				5	8	9 8	23	2	1.	02 0.60	6	16	9 8 0	- 5	0	5 1	M
4 6, 7 6, 1 6, 4 6, 3	08 56		4	21	21		8 2 5	4	8	8			05 3, 23						6 0	J.
. 3 6. 7 5. 6 6. 2 6, 0	3 50		6				2	3			0		02 1. 11			10 11 0	0	5	8 0	J.
6 5, 6 4, 1 5, 1 5, 2	33 32	NE., W.	5	12	18		5	2					50 0. 51				0	1	4 0	A
8 6. 1 3. 9 5. 3 5, 3	66 33	SW., NW.	7	8 6 9	9	10	13		12		3	0.	26 0. 23	5	22	3 3 0	2	1	0 2	S
6 6 1 5 2 5 3 6, 1	33 32		6	6	8	6	15		20		3		19 0. 19			8 2 0	21	0	0 2	10
6 0 7. 9 5. 3 6. 6 4, 6			6 2 3	9	33	- 5	14		8	9			56 0. 23			10 8 3	27	0		N
17.55.86.5 5,9		W	3	5	8	5	22	6	25	19			14 0, 09						0 0	D
8 6 6 5, 2 5, 9 75, 4	15		81	129	149	85	117	74	207	213	25	15.	56 3, 23	56	190	113 91 68	188	92	3 10	Y

# CAIRO, ILL. [H=850. h=78.]

4. 9. 5. 24. 34. 8 6, 321 5. 5. 4. 43. 84. 6 6, 411 5. 25. 23. 74. 7 7, 366 6. 35. 65. 55. 8 8, 57 4. 46. 33. 64. 8 5, 157 6. 95. 94. 65. 5 4, 746 8. 85. 83. 54. 4 3, 849 4. 54. 62. 84. 0 4, 884 4. 54. 62. 84. 0 4, 884 4. 34. 43. 54. 1 4, 534 6. 0. 5. 94. 85. 6 6, 067 5. 75. 73. 85. 1 6, 674 5. 25. 44. 0 4. 968, 348 14 14 6 13 21 0 20 0 9 0 0 0 0 0 0 2 0 16 0 0 0 0 1 0 9 14 10 1 6 18 1 0 3 1 7 8 8 4 1 1 SW. 18 9 15 16 12 13 23 5 25 7 16 12 2 8 12 34 W. S., N 17 14 12 24 25 11 12 26 20 9 4 12 10 5 14 16 3 11 16 4 9 SW 26 N. A. O. NW 6 8 22 87 114 203 132 134 134 67 24 37

#### CANBY, FORT, WASH.

[H=179. k=1.]

0 5. 7 4. 5 4. 7 10, 373	62	SE.	9	1	33	15		1	10	1	9 6, 68	1. 53	11	12	8		0	1	0	o	0	J.
4 6. 8 5. 5 6, 2 10, 235	68	S.	7	0	7	8		7	25	2	0 11.20	2.61	5	11	12	23	0	0	0	0	0	F.
0 5, 3 4, 0 5, 1 5, 791		SE.	22	3	7	5		5		4	1 1.15	0.44	10	10	11	8	0	0	0	0	0	M
8 4, 3 4, 6 4, 6 4, 863	24	S.	30	8	7 3	1	13	3	28	3	1 1, 12	0.51	10	13	7	8	0	0	0	0	0	Δ.
3 7. 8 7. 7 7. 9 5, 712	35	S.	15	5	2	5	20	2	40 37	4	0 3.45	0.78	0	13	18	14	D	0	0	0	0	M
57.27.87.8 4,445	22	W.	19	038526	2 3	5 2	18	3	37	7	0 3, 33	1.29	0	12	18	16	0	0	0	1	0	J.
8 5. 2 5. 0 5. 7 4, 950	28	SE.	19	6	3	6	17	4	25	12	1 0.22	0. 11	8	10		5	0	0	0	0	0	J.
1 2 6 3 6 3 4 4 243		N.	27	6	2	1	13	5	30		1 0.12	0.08	12	16			0	0	0	0	0	A
8 6 2 6 2 5 8 5,893	42	W.	12 21	3	1			14	27		2 3.43	0.88	7	15			0	0	0	0	0	S.
8 3, 7 5, 2 4, 2 6, 913	56	SE.	21	6	2	15	26			1	1 3.48	0.81	12	13	6	14	0	0	0	0	0	0,
89.49.09.413,107		8.	0	1	4	31				3	0 13, 72	1.49	0	2	28	28	0	0	0	0	0	N.
98.77.98.2 9,677	48	SE.	1	4	2	43	18	11	. 5	8	1 10, 50	1. 11	2	8	21	25	0	0	0	0	0	D
3 6, 1 5, 9 6, 1 86, 301			183	45	68	135	236	78	272	62	17 58. 46	2, 61	77	135	153	173	0	1	0	1	0	Y

#### CAPE HENRY, VA.

[Latitude, 36° 56' N.; longitude, 76° 0' W. Local time, 0.04 slow, Eastern.]

	Pr	055UF0.				Тез	npera	tur	в.			1	Dew p	oint.			ela: umi		
Months and year.	Mean.	Maximum.	Minimum.	7 a. m.	3 p.m.	11 р. m.	Mean.	Maximum.	Minimum.	Maximum.	Minimum.	7 & m.	8 р. ш.	11 р. ш.	Меап.	7 a. m.	3 p. m.	11 p.m.	Mean.
J F M J J S N D Y	In. 30. 147 29. 982 30. 061 30. 050 29. 933 80. 034 29. 975 30. 064 29. 991 29. 975 30. 053 30. 020	In. 30, 79 30, 50 80, 51 80, 58 30, 20 30, 20 30, 24 30, 24 30, 24 30, 38 30, 74 30, 79	29. 72 29. 66	0 40. 1 33. 9 36. 1 50. 4 59. 5 69. 4 74. 4 73. 6 60. 7 58. 6 47. 9 41. 0 54. 8	78. 0 85. 0 82. 6 76. 2 65. 2 55. 5 46. 4	52.8 60.7 69.2 75.7 75.0 68.2 59.5	54. 0 62. 3 72. 2 78. 4 77. 1 70. 4 61. 1 51. 3 43. 4	66 68 76 84 94 96 95 89 82 78 67	14 21 35 47 57 60 59 53 45 34 22	51. 8 43. 5 49. 0 02. 6 70. 1 80. 5 87. 6 84. 8 77. 8 68. 3 58. 2 51. 4	29. 1 32. 6 46. 8 56. 5 65. 0 71. 1 71. 4 63. 8 55. 5 44. 5	o 33. 2 26. 5 28. 9 43. 1 55. 8 62. 8 69. 0 68. 2 60. 7 52. 4 41. 4 48. 0	93. 0 27. 6 32. 1 45. 6 57. 5 63. 7 71. 2 66. 8 62. 6 54. 0 42. 9 37. 0 49. 7	33. 1 27. 8 81. 0 43. 7 56. 1 63. 3 69. 5 68. 2 61. 8 52. 3 42. 9 34. 4 48. 7	o 33. 1 27. 3 30. 7 44. 1 56. 3 62. 3 69. 9 68. 4 61. 7 52. 9 42. 4 35. 3	76 76 86 80 81 83 82 81 78	67 68 65 63 74 62 65 65 64 69 64 72 67	73 76 77 73 80 80 80 78 76 74 78	72 73 73 71 82 75 76 75 76 77 76 77 77

#### CAPE MAY, N. J.

[Latitude, 38° 56' N.; longitude, 74° 58' W. Local time, 0.02 slow, Eastern.]

#### CAPE MENDOCINO, CAL.

[Latitude, 40° 28' N.; longitude, 124° 24' W. Local time, 3.18 slow, Eastern.]

#### CEDAR KEYS, FLA.

[Latitude, 29° 8' N.; longitude, 83° 2' W. Local time, 0.32 slow, Eastern.]

J	30, 145	30, 45	29, 84	53, 2	60, 5	55, 9	56. 5	75	33	63, 2	50.9	47.6	50. 4	50, 3	49. 4	83	71	82	79
F	30, 035	30, 29	29.63	50.8	59.1	54.7	54.9	71	34	61. 9	49. 2				45. 3			76	72
M	30,096		29.80						39		53, 1				50. 2			78	75
A	30.042		29.78												59. 6				
M.,	29, 941		29, 75							81.6					65, 5			77	
J	30.021		29, 84						70		76. 1				78.3				
J	30, 022		29, 80						71		76.5				74.8				
Α	29, 963								70		75. 9				76. 0				
8	29, 934		29, 75						68						74. 0				
0	29, 928		29, 29						51						62. 5				
N	30, 017		29, 73						39						54.9				
D	30. 137								31		44. 9				47.7				
Y	30, 023	30, 47	29. 29	00. 3	12.0	01.4	05. 5	92	31	75. 1	62. 6	60, 3	01.0	0T B	61. 2	24	40	(82)	79

## Monthly and yearly meteorological summaries—Continued. CAPE HENRY, VA.

										[ <i>H</i>	<b>=</b> 10	5.	<b>k</b> =	6. j													
	loud n te						•	Wir	ıd.							Pre	cipi- ion.		N	m	ber	of	ds	ye	۱.		
7 A.m.	8 p. m.	11 p.m.	Mosn.	Total (miles).	Maximum.	Direction.	North.	Northeast	East.	Southeast.	South.	Southwest.	West	Northwest.	Calma	Total	Max. 24 hours.	Clear.	Fair.	Cloudy.	Rain or snow.	below	Min. belc ▼ 32°.	Max. above 90°.	Thunder-storms.	Aurorae.	Months and year.
4. 4 4. 2	4.6 4.8 5.5 4.5 4.1 3.7	4.0 5.4 5.2 5.3 2.5 3.2 3.2 3.2 3.2 3.2 3.2 3.2 3.2 3.2 3.2	5.5.1 5.5.2 5.3.2 8.8.9 8.8.9	9, 879 10, 287 9, 649 8, 632 8, 207 7, 842 8, 780 9, 326	47 40 56 41 44 32 45	NW. NE. NW. NE. SW. NW. N.	16 27 21 4 11 12 8 10	17 22 11 13 17 87	11 11 11 0	14 10 10 5	18 19 11 15 16 18	11 12 14 8 16 28	4 5 3 4 0	9	8 1 2 2	8.73 2.51 1.45 4.98 2.26 2.89 2.87 2.83	0. 51 0. 67 1. 57 1. 03 0. 99 0. 75 1. 33	8 10 14 8 14 17 12 15	11 10 13 14 10 12 16	11 9 6 2 8 5	14 7 18 9 10 7 5	2000000	11 18 13 0 0 0	00000212600	0 0 1 8 2 8 6 0 0 2	000000000	J. F. M. A. M. J. J. A. 8. O

5 35.64.65.2 11,579 5.94.64.65.0 9,879 4.65.45.45.1 9,649 5.36.55.06.3 8,632 3.94.55.25.9 8,207 3.3.55.55.5 6.3 8,632 4.4.13.03.9 8,780 4.23.72.9 8,6 9,326 4.34.92.53.9 10,139 5.65.45.45.4 10,521 4.34.52.73.8 12,078 4.64.78.64.8 15,919	47 N. 16 47 NW. 27 40 NE. 21 56 NW. 4 41 NE. 11 44 SW. 12 32 NW. 8 45 N. 10 51 NW. 10 52 E. 19 44 N. 13 53 N. 18	5 4 5 15 4 4 17 8 9 22 13 12 11 11 14 13 11 10 17 11 10 37 9 5 18 11 11 5 1 8 ·8 1 5	17 17 11 13 8 11 8 15 19 14 5 9 11 8 4 9 9 11 8 19 4 2 11 11 15 0 8 13 13 8 4 8 12 11 21 14 14 177 181 74 116	3 8. 360 69 1 8. 730 85 2 2 510 .51 1 .450 .67 3 4 .931 .57 1 2 .261 .03 2 2.89 0.99 2 2.87 0.75 0 2.331 .33 1 2.49 0.74 1 2.41 .55 1 8.49 1.39 22.36 .55 1.57	9 12 10 14 0 8 11 9 13 4 10 11 14 2 14 12 8 7 0 8 14 9 18 9 14 10 6 9 0 17 12 2 10 0 12 16 8 7 0 13 12 6 9 0 8 12 10 11 0 8 12 0 11 0 16 8 7 6 0 144 140 8 123 6	111 0 0 0 0 J. 12 0 1 0 F. 12 0 1 0 M. 0 0 3 0 J. 0 0 2 0 M. 0 12 6 0 J. 0 12 6 0 J. 0 0 0 0 8. 0 0 0 0 N. 10 0 0 0 D. 12 0 0 U.
			MAY, N. J =27. h=6.]			
5. 25. 84. 45. 1 12, 455 6. 95. 34. 15. 4 12, 403 5. 35. 85. 35. 5 12, 476 4. 83. 94. 24. 3 10, 909 5. 16. 45. 05. 5 9, 165 8. 74. 83. 83. 9 9, 429 4. 44. 972. 1, 3. 8 7, 482 4. 95. 33. 44. 5 9, 450 4. 13. 73. 83. 9 9, 243 8. 65. 12. 73. 8 10, 606	62 NW. 12 55 NW. 8 54 NW. 12 70 NW. 6 32 NW. 6 48 8W. 5 40 E. 2 40 SW. 7 56 NW. 5	13 4 8 9 12 14 10 25 17 4 4 24 9 17 17 8 10 21 14 14 8	19 8 16 22 2 5 9 34 17 12 6 28 22 6 6 17 10 5 6 17 27 8 7 6 21 11 7 8 18 14 1 15 15 4 27	0 4.98 1.24 0 8.71 1.55 0 2.29 0.66 0 1.87 0.65 0 5.20 2.07 0 2.23 0.67 0 1.57 0.68 0 3.47 1.03 1 0.81 0.39	6 21 4 12 8 6 16 6 11 6 4 19 8 14 3 10 16 4 8 0 12 15 8 7 0 10 18 3 5 0 11 12 7 5 0 13 12 6 8 0	17 0 0 J. 23 0 0 F. 18 0 0 M. 2 0 0 M. 0 0 0 M. 0 0 0 J. 0 0 0 J. 0 0 0 J. 0 0 0 S. 0 0 0 N D.
			INDOCINO, 637. $\lambda = 1.$	CAL.		
6. 3 6. 0 6. 2 6. 2 16, 287 5. 8 4. 45. 6 5. 3 16, 404 2. 93. 0 5. 1 3. 7 14, 161 4. 43. 9 5. 7 4. 7 11, 471 4. 0 4. 1 4. 9 4. 3 13, 002 2. 7 4. 7 6. 6 4. 8 10, 821 2. 7 4. 7 6. 6 4. 8 10, 821 2. 7 4. 7 8. 2 6 2. 6 19, 134 2. 4 1. 8 2. 6 2. 6 14, 310	92 S. 27 104 SE. 29 56 SE. 42 48 SE. 34 42 SE., N. 37 43 NW., N. 30 44 NW., N. 30 47 SE. 67	0 2 18 0 1 16 1 0 15 1 0 0 1 0 4 1 0 11 0 0 1	39 0 1 2 11 0 1 23 9 0 0 22 4 3 0 26 3 0 1 36 5 0 0 21 16 1 0 31 3 0 0 19 2 0 0 13	2 1. 91 0. 51 0 1. 37 0. 64 3 0. 34 0. 06 7 0. 92 0. 27 6 0. 62 0. 24 3 1. 32 0. 46 3 0. 32 0. 13 0 0. 82 0. 26 4 1. 59 1. 25	8 13 7 8 0 12 17 2 4 0 9 17 4 8 0 4 25 2 2 0 4 22 4 3 0 18 11 2 0 0 21 9 1 0 0	0 0 0 0 J. 0 0 0 0 F. 0 0 0 0 M. 0 0 0 0 M. 0 0 0 0 M. 0 0 0 0 J. 0 0 0 0 J. 0 0 0 0 J. 0 0 0 0 A.

#### 1. 82. 02. 0 14. 310 47 6. 6. 3. 84. 34. 2 10. 708 48 7. 5. 7. 6. 7. 0. 7. 4 20. 569 125 5. 9 5. 0 5. 1 5. 3 17. 470 104 4. 5. 3. 9 4. 8 4. 4 178, 247 ... 1 4 5 1.11 0.34 12 14 5 0 6 0 7.34 0.90 2 919 0 9 2 2.71 0.53 8 13 10 4 212 35 20.37 1.25 123 175 67 SE. SE. 34 17 26 1 2 1 0000 0000 000 21 0 0 0 000 N. D. Y. 0 46 39 18 14 6 469 14 10 208 137

#### CEDAR KEYS, FLA. H = 22.A=35.] 4. 25. 75. 45. 1 7, 529 2. 9.2. 37.2. 93. 3 6, 238 5. 1 4. 83. 64. 5 5, 748 4. 2 4. 42. 83. 8 6, 018 5. 45. 64. 45. 11 6, 566 6. 96. 014. 15. 6 4, 585 6. 57. 06. 46. 6 4, 571 6. 96. 68. 68. 6 6, 044 6. 2 6. 7 6. 06. 3 5, 063 5. 65. 2: 41. 15. 0 7, 230 3. 65. 04. 04. 2 5, 220 2. 65. 12. 44. 0 6, 244 5. 15. 44. 45. 0 71, 123 5 14 5 2 10 9 11 5 12 12 4 20 7 22 8 4 2 11 26 8 8 19 16 15 8 2 5 17 27 4 8 9 30 22 4 9 11 25 23 5 5 4 12 21 4 2 4 11 20 14 5 8 7 11 25 4 7 5 12 25 68 114 151 213 122 3 4.971.96 9 16 3 9.023.27 16 9 4 3.071.74 12 13 8.0.150.11 13 14 0 3.481.32 7 15 8 10.983.68 4 20 7 9.174.61 21 17 010.092.56 21 15 3 5.763.14 31 18 1 4.38 2.00 8 14 5 1.170.57 14 11 10 3.84 2.07 12 17 52 66.08 4.61 102 179 80 85 87 43 26 29 23 36 28 E. 48 33 P. 19 7 8 17 9 17 5 9 16 18 9 000000000000 J. F. M. A. J. J. 24 20 15 4 7 2 1 16 7 16 6 9 3 13 6 14 3 15 9 20 6 17 12 15 14 18 9 14 9 11 5 17 2 6 14 3 9 6 10 8 2 9 10 6 15 12 16 14 18 9 12 9 10 5 5 2 8 84 129 000000000000 00000625200 201139995101 5 15 11 8 7 7 18 7 13 6 A. S. O. N. D. 8.

#### CHARLESTON, 8. C.

[Latitude, 32° 47' N.; longitude, 79° 56' W. Local time, 0.20 slow, Eastern.]

	Pro	9 <b>95</b> UF9.				Ter	npera	tur	B.			I	ow b	oint.		bu	iola unic	live	
year.										Me	an.								
Months and	Mean.	Maximum.	Minimum.	7 a. m.	3 p. m.	11 p.m.	Mean.	Maximum.	Minimum.	Maximum.	Minimum.	7 s. m.	3 p. m.	11 p. m.	Meen.	7 a. m.	8 p. m.	11 р. ш.	Mosn.
J F M J S O D Y	7n. 30, 128 24, 967 30, 021 29, 917 30, 015 29, 984 29, 943 29, 943 29, 992 30, 009 30, 003	Yn. 30. 58 30. 40 30. 51 30. 43 30. 12 30. 20 30. 17 30. 14 30. 21 30. 55 30. 56	In. 29. 78 29. 85 29. 62 29. 62 29. 76 28. 71 29. 58 29. 54 28. 71	0 46. 8 42. 8 46. 9 58. 8 76. 8 77. 2 73. 5 60. 7 53. 4 45. 7 60. 8	54. 6 52. 1 57. 7 70. 8 77. 9 84. 6 87. 1 85. 2 80. 4 70. 4 64. 7 56. 1 70. 1	50. 8 47. 7 52. 0 62. 8 71. 3 77. 1 80. 3 79. 4 75. 2 64. 5 57. 8 49. 8 64. 0	47. 5 52. 2 63. 8 72. 7 79. 5 81. 9 80. 6 76. 4 65. 2	72 84 90	22 84 43 54 66 68 68 63 46 84 28	58- 8 55. 2 59. 9 71. 8 79. 9 86. 8 89. 1 87. 4 81. 8 71. 4 66. 5 58. 6 72. 3	40. 7 44. 6 56. 7 78. 8 75. 7 76. 6 71. 1 58. 0 51. 2 41. 8	0 41. 0 87. 5 41. 2 52. 0 62. 6 71. 1 72. 7 73. 1 69. 6 348. 3 89. 0 55. 4	0 41.5 38.3 42.9 51.7 61.8 71.0 74.4 74.0 70.7 56.8 50.4 38.4 56.0	0 43.7 41.8 45.4 54.0 62.9 71.6 74.8 74.6 70.1 58.1 51.0 40.2 57.4	48. 2 62. 4 71. 2 74. 0 78. 9 70. 1 57. 1 49. 9	81 79 82 83 84 87 88 86 83 78	50 54 59 65 67 71 78 64 62 55	84 86 86 90 78 72	77

#### CHARLOTTE, N. C.

[Latitude, 35° 13' N.; longitude, 80° 51' W. Local time, 0.23 slow, Eastern.]

#### CHATTANOOGA, TENN.

[Latitude, 35° 4' N.; longitude, 85° 15' W. Local time, 0.41 alow, Eastern.]

#### CHEYENNE, WYO.

[Latitude, 41° 8' N.; longitude, 104° 48' W. Local time, 1.59 alow, Eastern.]

	50 34	100.00	400	100	15.00	2.30		-	100			100	201	200	1000	133		9	
J	23, 896		23, 53								10. 7				12.2				.64
F	23, 855	24, 21	23, 52	20. 2	30. 6	23.0	24. 6	52	-12	34. 5	14.3	13. 3	17.0	15. 2	15, 2	78	61	75	(B)
M.	24. 041	24, 25	23, 82	27.7	42.1	31. 3	33, 7	61	3	44.7	23.4	20.3	19.8	23, 6	21. 2	75	46	75	160
A	23, 932	24, 20	23.54	33, 7	48.8	39.7	40.7	65	19	53. 0	31. 2	28, 2	28, 1	31.0	29, 1	82	-51	79	救
Æ.	23.978	24, 20	23, 76	38, 2	56. 4	45.4	46.7	79	22	60. 5	36. 2	34. 0	34.5	38.0	35, 5	85	47	77	20
J	24, 051	24, 32	23, 49	48, 6	68. 8	55, 3	57. 6	81	35	72.8	46, 3	43, 4	45, 6	45, 9	45, 0	84	45	73	6
T VI	24, 111	24, 26	23, 89	55. 7	78.0	63. 5	65, 7	90	45	80.8	53, 2	47, 1	47. 1	51.6	48. 6	75	36	67	(3)
A	24, 125	24, 31	23, 90	52. 5	73, 5	60, 5	62. 2	87	40	76. 7	50, 6	44. 1	47.1	48.6	46, 6	75	43	rsk.	6
	24, 068									70. 1	43, 7	35, 9	41.0	40.8	39. 2	71	44	173	N
)	24, 069	24, 27	23, 75	37. 3	57. 2	42.6	45.7	75	14	60, 0	33. 6	26. 5	27. 5	26.8	26. 9	68	57	8/7	N
T	23, 941	24, 24	23 39	33. 5	48, 2	35, 3	39, 0	67		51. 3		22, 1			24.1		45		b
D	23, 961																	10	2
	24, 002																	60	6
D Y									24, 28, 23, 46, 29, 8, 40, 7, 29, 4, 33, 3, 64, 32, 32, 39, 36, 9, 53, 4, 41, 8, 44, 0, 90			24. 28 23. 46 29. 8 40. 7 29. 4 33. 3 64 -12 44. 4 21. 7 24. 32 23. 39 36. 9 53. 4 41. 8 44. 0 90 -19 56. 9 32. 7							

## Monthly and yearly meteorological summaries—Continued. CHARLESTON, 8. C. [H=52. h=53.]

										[	H=	= 52	2. /	<i>i</i> =	53.]						_							_	_
		din						V	Vind	l.							Pre	ci) tio	pi- n.		Nu	mb	er (	of d	ay	8-	_		
7 a. m.	3 p. m.	11 p. m.	Mean.	Total (miles).		Maximum.	Direction.	North.	Northeast.	East.	Southeast.	South.	Southwest.	West	Northwest.	Calms.	Total.	1:	Max. 24 hours.	Clear.	Fair.	Cloudy.	Rain or snow.	Max. below 32°.	Min. be low 320.	Max. above 90°.	Thunder storms.	Aurofas.	Months and year.
5.45 5.85 5.55 5.86 4.03	56466777544	24. 84. 43. 43. 55. 05. 134.	55. 55. 55. 55. 55. 56. 56. 56. 56. 56.	5, 5, 5, 5, 6, 5, 5, 5, 5, 5, 5, 5, 5, 5, 5, 5, 5, 5,	385 692 227 746 151 026 975 540 765 035 160 480 794	28 36 24 36 22 24 18 (*) 26 36 16	SW. NE. NE. E. SE. SE. NE. NW.,W	15 8 12 9 6 5 3 1 8 13 12 89	9	3 6 12 13 14 22 9 21 24 10 5 1	0 0 3 2 3 0 8 11 13 10 8	10004404557737	24 26 31 87 48 30 58 25 7 9 11 9	15 20 15 9 4 6 8 12 4 10 8 38 149	8 8 5 8 8 3 2 1 5 8 8 19 9 84	4 6 11	5. 9 7. 4 19. 1 3. 3 8. 0	8 1 4 1 6 0 7 0 6 2 9 2 8 5 9 5 9 4 (	. 40 . 68 . 71 . 91 . 38 . 24 . 89 . 80 . 40 . 40	10 14	17 13 16 18 12 12 13 13	10 8 11 11 4 7	18 11 10 6 10 12 13 18 14 0 10	(	80000000	01477000	1 0 4 13 13 16 2 0	0000	D.
-	H	urr	Cal	e, re	cor	d lo	st.		<u>'</u>		TAE		OT.		N.						·								
5, 1 4, 5 4, 5 4, 6 6, 6 4, 6 4, 6 4, 6 4, 6 4, 6 4, 6	5.5.6.6.4.6.3.	0 3. 9 3. 2 2. 5 3. 6 3. 6 4. 5 3. 3 3. 9 3.	24.	5 3, 6 4, 1 4, 5 3, 6 3, 6 2, 1 2, 6 3, 7 3,	509 231 266 704 381 527 131 572	23 22 21 18 21 19 26 17	SW. NW. W. NW. NW. SE, SW. E. SE. NW. NW.	19 11 7 9 11 5 11 6 13 9 12 6 119	16 29 23 10 15	3 8 5 6 8 16 6 13 16 9 2 4 96	2 1 2 4 6 9 10 6 1 9 6 1 5 7	8 4 14 13 13 17 10 13 15 11 17 7	22 19 23 21 10 11 12 35	10 8 7 8 8 8 6 7 2 4 9 12 80	9 11 10 10 6 8 6 2 14 18 13	3 10 5 2 2 3 4	4. 2. 2. 6. 6. 4. 6. 4. 6. 4. 6. 4. 6. 4. 6. 6. 6. 6. 6. 6. 6. 6. 6. 6. 6. 6. 6.	54 ( 51 ( 53 ) 47 ( 48 ( 31 ) 45 ( 54 ) 71	L 77 0, 94 0, 97 L 03 L 73 0, 85 2, 15 1, 24 2, 86 2, 82 1, 78 2, 86	11 14 9 10 10 9 8 16 12 13	12 13 16 18 18 18 18 18 18 18 18 18 18 18 18 18	3 7 9 7 9 7 9 7 9 7 9 6 9 9 9 6 1 7 2 6	10 12 9 14 11 10 10 10 10 12 11	0 0 0 0 0 0 0 0 0 0	1	7 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	7 8 6 4 6 1 6 1 6 1 6 1 6 1 6 1 6 1 6 1 6 1	0 0 0 0	M. A. M. J. J. A. S. O. N.
		-							C	HA			700 783.		., T =59		N.												
5. 1 5. 5 5. 4 4. 2 4. 0 5. 0 5. 0 5. 0	5. 4. 4. 5. 5. 6. 6. 5. 4. 5. 4.	0 3, 9 2, 1 3, 7 3, 4 3, 1 4, 7 4, 2 3, 4 4,	2 6. 9 4. 1 4. 5 4. 9 4. 9 5. 6 4. 6 4. 9 4. 9 4. 9 5. 9 4. 9 5. 9 4. 9 5. 9 6. 9 7. 9 7.	7 4, 2 4, 2 5, 5 3, 5 3, 8 3, 6 3,	508 890 309 004	20 29 22 26 28 22 19 24 26 38	NW. NW. NW. NW. SW. E. NE. NE. SW. SW.	3 8 14 6 8 8 8 8 7 7 7 8 8 8 8 8 8 8 8 8 8 8 8	10 12 7 10 9 6 6 9 34 15 11	4 0 1 1 3 3 3 4 4 4 3 7	10 8 7 8	66 88 26 14 16 6 13 12 7 14 17	19 20 15 17 26 34 25 25 27 13 7 7 21	8 8 8 13 13 14 16	13 15 15 15 15 15 15 15 15 15 15 15 15 15		0 3. 1 1. 2 1. 4 5. 2 6. 2 4. 4 4. 2 6. 2 5. 6 6.	79 60 12 09 86 06 48 03 18 41	1. 6: 0. 57 0. 6: 0. 0: 2. 0: 1. 3: 0. 0: 2. 5: 1. 4: 2. 8: 1. 3:	1 10 1 13 1 13 1 13 1 13 1 13 1 13 1 13	0 10 3 12 1 1 3 1 7 1 8 1 1 5 1 3 1 3 1	0 8 2 6 4 4 1 7 6 8 9 8 1 10 9 8	8 1 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8	3 3 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	1	6 9 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0 1 0 1 4 1 0 0 0	1 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	J. J. M. A. O M. J. O J. O J. O J. O J. O J. O J.
													NN 105.		<b>W</b>														
24.07 24.07 24.01 24.01 24.01 24.01	348554448554	764.283.3.3.24.3.3.2.26 72.3.3.3.2.4.3.3.2.2.3.3.3.2.4.3.3.3.2.2.3.3.3.2.2.3.3.3.3	3.4.8.5.4.8.5.5.3.8.8.8.3.8.8.3.8.8.3.8.8.3.8.8.8.8	3 10, 3 9 8 7 3 6 6 10 7 9 8 9 7	936 325 621 706 896 245 , 571 , 065 , 195 , 276 , 496 , 715	52 56 46 40 36 50 47 38 44 38 44 36 44 36 44	NW. S. NW. W. W. NW.	11 11 15 16 11 11 11 11 11 15	1 60 7 60 8 60 8 60 8 60 4 40 9 44 9 22 1 1	2	2 4 9 6 8 9 15 11		7 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8	3 1 5 1 6 1 8 1 8 1	B 4 2 2 2 7 2 2 6 2	7 8 1 0 4	0 1. 0 0. 1 3. 0 1. 5 2. 2 1. 2 2. 1 0. 0 3 1.	51 76 33 75 91 14 69 28	0. 0 0. 5 0. 2 1. 8 0. 3 1. 2 1. 0 0. 4 0. 2 0. 1 0. 7	3 1 7 1 3 2 1 0 5 1 7 1 2 1 2 1	0 1 7 9 1 9 1 9 1 9 1 3 1 2 1 1 1	8 18 19 17 12 15	5 1 6 1 7 1 2 1 1 1 7 1	722247965	0 2 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3	5 17 5 0 0 0 10 23	0000	00259030000	0 J. 0 F. 0 M. 0 A. 0 J. 0 J. 0 S. 0 O. 0 N.

#### CHICAGO, ILL.

[Latitude, 41° 52' N.; longitude, 87° 38' W. Local time, 0.50 slow, Eastern.]

	Pro	988ure.				Ter	npera	tur	в.			3	Dew I	oint.			Rela umi		
Months and year.	Mean.	Maximum.	Minimum.	7 a. m.	3 р. т.	11 p. m.	Mean.	Maximum.	Minimum.	Maximum.	Minimum. F	7 a. m.	8 p. m.	11 p. m.	Mean.	7 a. m.	8 p. m.	11 p. m.	Mean.
J F M A J J S O N D	7n. 29, 382 29, 263 29, 236 29, 202 20, 209 20, 311 20, 267 20, 323 20, 267 29, 246 29, 311 29, 290	29, 58 29, 51 29, 60 29, 53 29, 60	In. 28, 48 28, 69 28, 76 28, 82 28, 89 26, 04 26, 90 28, 75 28, 42 28, 42 28, 42	62. 4 69. 2 64. 9 60. 1 47. 1 39. 3 29. 2	20.8 32.9 48.1 56.0 70.0 71.3 67.8 55.0 44.4 83.5	30. 6 45. 1 52. 8 63. 8 72. 2 68. 0 63. 8 50. 9 41. 9 80. 7	45. 8 62. 8 65. 4 72. 8 68. 1 63. 9 51. 0 41. 9 81. 1	47 58 76 80 88 94 85 81 69 66	- 8	73. 6 80. 8 74. 3 70. 6 57. 6 48. 7 88. 9	8. 8 23. 7 38. 7 46. 1 57. 1 65. 5 62 4 58. 3 45. 5 86. 7 24. 7	7. 1 20. 8 87. 2 42. 0 55. 0 62. 8 58. 2 52. 6 41. 3 83. 8 24. 5	15. 5. 24. 6 88. 2 42. 5 54. 7 63. 6 57. 2 54. 1 42. 5 85. 3 27. 6	12.0 23.6 88.6 44.2 55.7 64.5 59.9 55.4 42.9 84.5 25.7	11. 5 23. 0 98. 0 42. 9 55. 1 63. 6 58. 4 54. 0 42. 2	79 79 81 76 78 80 77 81 80 82	67 80 72 70 63 60 65 63 64 64 72 79 68	77 80 75 78 74 75 77 76 82 77	75 76 71 71 74 73 72 74

#### CHINCOTEAGUE, VA.

#### [Latitude, 37° 55' N.; longitude, 75° 23' W. Local time, 0.01 slow, Eastern.]

J F M.	30, 135 29, 977 30, 054 30, 050	30, 49	29, 62	29.3 32.9	34. 1 39. 5	31.0	31.5 35.7	55 60	13 8 11 31	39.1 42.8	28. 4 23. 9 27. 1 41. 5	26. 0 28. 5	26. 6 30. 2	25.8 29.5	30. 26.1 29.4	87 84	75 71	81 82	81 79
М. J	29, 937 30, 024 29, 968	30. 21 30. 30	29, 51 29, 35	57. 9 67. 5	64. 6 74. 7	57.1 65.9	59. 9 69. 4	81 90	41 52	67. 2 77. 6	52, 2 61, 7 70, 1	53. 9 61. 6	54. 9 60. 8	53.4 62.2	42, 4 54, 1 61, 5 69, 8	87 82	78 64	£8 88	83 78
A S O.	29, 974 30, 066 29, 998	30, 36	29. 49 26. 19	65.3 57.2	71.0 61.6	85.7 57.7	67. 3 58. 8	82 75	56 44 39	82.1 73.0 64.7	68.9 59.0 49.7	67. 1 59. 2 52. 4	67.4 57.8 52.1	68. 1 60. 4 52. 1	07.5 59.1 52.2	82 81 84	68 65 72	87 84 82	79 77 70
N D Y	29, 964 30, 045 30, 016	30.76	29.32	38. 1	43.6	39.5	40.4	64	18	54. 7 48. 9 61. 6	32, 9	32.0	32, 3	31.7	41.8 32.0 47.2	79	66	74	73

#### CINCINNATI, OHIO.

#### [Latitude, 39° 6' N.; longitude, 84° 30' W. Local time, 0.38 slow, Eastern.]

#### CLEVELAND, OHIO.

#### [Latitude, 44° 30' N.; longitude, 81° 42' W. Local time, 0.27 alow, Rastern.]

J       29. 335       29. 91       28. 45       17. 9       23. 8       21. 0       20. 9       54       - 7       28. 9       13. 4       14. 5       17. 5       16. 6       16. 2       86 78       83         H       29. 290       29. 67       28. 8       81. 2. 4       20. 1       16. 7       16. 4       47 -15       36. 2       7. 3       9. 5       15. 0       11. 9       12. 1       89       81       81         M       29. 290       29. 67       28. 74       20. 8       28. 0       24. 4       26. 4       36. 8       18. 8       17. 3       21. 4       19. 9       18. 5       86       77. 82         A       29. 300       29. 67       28. 74       40. 8       47. 7       48. 5       44. 0       83       22       54. 0       36. 9       35. 2       37. 4       36. 4       28. 77. 82         M       29. 208       29. 52. 2       28. 78       85. 2       45. 8       95. 4       40. 83       22       54. 0       83       28. 16. 8       37. 4       40. 8       29. 26       28. 16. 16. 16. 16. 16. 16. 16. 16. 16. 16	84 82 77 76 79 84 77 82 81 80
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CHICAGO, ILL.

_												(H:	=66	1.	h=	= 93	.]				_								_
	lot n i			88 18.						WI	nd.								ecipi- tion.		N	um	ber	of	day	78-	-		
7 A. m.	8 p. m.	11	11 p. m.	Mean.		Total (miles).	Maximum.	Direction.	North.	Northeast	East.	Southeast	South.	Southwest.	West	Northwest.	Calms.	Total.	Max. 24 hours.	Clear.	Fair.	Cloudy.	Rain or snow.	Max. below 82°.	Min. below 32º.	Max. above 90°.	Thunder storms.	Auroras.	Months and veer
5.2 4.8 5.7 5.4 5.7 5.4 6.8 4.7	566554.4.7.7.6	7 5 5 7 5 7 5 7 5 7 5 7 5 7 5 7 5 7 5 7	1.14	5. 7 6. 1 4. 9 4. 5 4. 6 4. 5 6. 7 5. 4	4 5 6 5 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6	233 092 726 136	22 24 28 24 80 24 26 27 25 21 24 26	SW. NE. SW. N. N. N. N. S. NE., N. SW., W.	5 17 18 28 13 14 16 12 18 7 6	5 6 11 12 13 5 12 13 5 6 9 4	7 1 6	10 8 9 6 8	10	32 28 20 7 12 13 11 14 15 12 20 85 219	22 12 15 7 9 11 10 9 12 16 21 14 158	5 9 6 13 15	3 7 2 3 5 10 0 1 1 0	3. 0 0. 5 4. 0 3. 1 5. 2 2. 4 11. 2 2 9 3. 8 2. 3 8. 8	8 1. 24 1 0. 86 7 0. 20 0 1. 71 7 1. 23 0 3. 44 4 0. 83 8 6. 19 7 1. 65 7 2. 22 3 1. 17 5 1. 29	3 10 3 11 9 9 8 13 8 4 8 8	13 13 13 15 16 16 18 13	9 8 7 6 2 5 9 10 13 8	13 9 11 12 15	0 0 7	0 0 0 4 20	000000000000000000000000000000000000000	9	0 0 0 0 0 0 0 0 1 0 0 0 1	J.F.MA.MJ.J.A.S.O.NDY
		_				'			<u>''</u>		CH				GU À=		V.	۱.	•						•				
7.0 5.9 3.7 7.6 4.0 3.8 3.3 4.1 5.7 4.4	本在 五五 弘 五 五 五 五 五 五 五 五 五 五 五 五 五 五 五 五 五	7 5 5 4 5 6 4 5 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3	1 6 1 8 4 6	5.9 4.0 5.4 3.8 3.8 3.7 5.4	9, 9, 7, 6, 5, 5, 6, 9, 11,	348 721	48 52 40 50 44 39 24 40 37 33 41 54	NW. NW. NW. NW. S. S. NE. N. NW. NW.	14 13 14 3 10 3 9 6 13 19 10 117	16 11 20	2 8 2 13 18 10 8 15 20 13 2 2 113	13 10 32 20 11 3 11 1	21 10 19 20 18 12 28 12 19 8 11 14 192	5 3 4 5 2 4 10 20 6 10 20 7	7 2 7 7 5 2 2 3 3 5 8 14 65	22 37 23 15 11 17 3 5 9 14 24 32 212	4 1 1 1 1 0 3 3 7 4 7 2 3 3 3 5 2 3 5 3 5 3 5 3 5 3 5 3 5 3 5	2.00 2.21 0.97 7.21 1.83 3.21 1.93 6.90 4.10	0 1. 14 0 0. 75 5 0. 82 7 0. 44 2 2. 03 2 0. 49 8 1. 43 4 1. 05 3 1. 50 2 0. 80 6 2. 44 6 1. 47 5 2. 44	6 5 14 3 13 18 15 18 13 8 12	13 9 16 11 9 11 8 15 13 14	11 13 7 12 6 4 5 4 3 9 5	14 12 11 9 19 6 4 10 7 8 9 6 6 115	5 6 4 0 0 0 0 0 0 0 0 0 0 0 15	20 24 23 1 0 0 0 0 0 2 12 82	000000000000000000000000000000000000000	0 0 0 1 3 4 4 3 1 2 1 9	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	J.F.M.A.M.J.A.S.O.N.D.Y.
					_								ZIN = 62		TI,			).									-	-	
6.15 3.5 (5.5 6.15 6.34 6.5 (5.5 6.05	4, 0 5, 7 5, 5 5, 9 5, 9 5, 9 7, 9	44543233464	28345917328	4.9 5.3 5.7 4.1 4.1 5.1 6.8 5.6	35544443457	278 278 621 776 486	38 30 23 34 40 31 40	SW. NW. W. SW. W NW. NE. NW. NW. NW. NW. NW. NW.	11 8 12 1 5 7 4	9 8 6 11 4	8 4 8 7 2 1 6 11 7 2 1	4 5 27 18 22 21 22 19 15	1 6 1 6 5 1	24 10 12 19 18 14 10 14 21 25	7 13 6 5 6 3 15	16 11 13 12 23 19	6 5 14 11 6 6 10 21 4	2, 67 0, 56 3, 34 2, 07 3, 98 1, 40 4, 95 2, 72 2, 30 2, 33 1, 82	1. 69 1. 39 0. 18 0. 86 0. 45 0. 78 0. 40 2. 62 1. 25 0. 58 0. 92 0. 90 2. 62	12 10 4 7 9 7 10 14 9 8 4 10 104	7 10 17 12 13 16 18 14 13 15 11 9	12 8 10 11 9 7 3 8 8 15 12 106	10 12 15 13 13 13 12 7 13 9 13	000000004	24 25 26 5 0 0 0 0 1 6 18	0 0 0 0 0 0 14 4 0 0 0 0 14 18	1 1 0 2 4 8 5 9 3 0 1 0 34	0 0 0 0 0 0 0 0 0	J.F.M.A.M.J.J.AS.O.N.D.Y

## (H = 690. h = 73.)

#### COLUMBUS, OHIO.

[Latitude, 39° 58' N.; longitude, 83° 0' W. Local time, 0.32 slow, Eastern.]

	Pr	068ur6.				Te	mper	atu	re.			I	)ew I	oint.			lela umi		
year.										Me	an.								
Months and	Mean.	Maximum.	Minimum.	7 а. ш.	8. p. m.	11 р. m.	Mean.	Maximum.	Minimam.	Maximum	Minimum.	7 & m.	3 р. m.	11 р. ш.	Mean.	7 a. m.	8 p. m.	11 p. m.	Mesn.
J F M J J 8 O N U	In. 29. 251 29. 122 22. 197 29. 165 29. 073 29. 183 29. 140 29. 127 20, 130 29. 121 20, 199 29. 160	29. 38	28. 65 28. 81 28. 94 28. 69 28. 78 28. 67 28. 84	0 19. 7 14. 2 24. 8 48. 2 54. 9 63. 6 70. 4 65. 1 57. 0 44. 8 37. 5 30. 0 43. 8	-84. 5 56. 1 67. 6 75. 2 88. 5 76. 9 73. 1 57. 9 44. 6 36. 6	20. 5 49. 1 59. 6 67. 6 75. 1 67. 9 61. 3 49. 0	19 4 29. 6 49. 5 60. 7 68. 8 70. 3 70. 0 63. 8 50. 6 40. 9	84 86 90 97 91 82 77 69	-11 23 85 46 51 50 89 29	80. 8 29. 5 38. 8 60. 0 71. 4 78. 8 86. 0 79. 7 74. 2 60. 8 47. 4 40. 1 58 1	9. 2 21. 9 39. 9 51. 0 59. 2 67. 2 62. 5 53. 7	o 15. 7 10. 9 20. 2 39. 2 50. 1 57. 3 65. 0 61. 7 53. 1 41. 6 32. 8 25. 3	66. 6 64. 1 55. 5	0 17. 4 15. 5 23. 4 42. 8 53. 5 59. 8 60. 4 62. 8 56. 8 43. 6 25. 0 41. 8	0 17.4 14.8 22.5 42.1 52.3 59.0 66.0 62.9 55.0 43.2 26.3 41.4	87 82 86 86 89 83 89 87 89 86 82	74 76 66 62 61 58 65 56 63 73 74 66	84 82 82 78	80 82 75 77 78 72 79 76 78 80 78

# FORT CONGHO, TEX. [Latitude, 31° 25' N. ; longitude, 100° 24' W. Local time, 1.41 slow, Eastern.]

J F M J J S	28, 042 28, 021 28, 073 28, 102 28, 075	28. 44 28. 48 28. 31 28. 30	27. 64 27. 89 27. 78 27. 68 27. 82 27. 93 27. 87	84. 2 44. 1 55. 8 59. 6 71. 5 71. 9 71. 4	55. 8 61. 8 75. 9 77. 9 98. 2 94. 7 93. 9	41. 0 50. 7 62. 3 65. 3 77. 9 79. 8 79. 7	43. 7 52. 2 61. 7 67. 6 80. 9 82. 1 81. 7	80 90 92 108 107 105	11 80 43 44 62 64 62	81.8 96.7	81. 8 42. 1 54. 2 57. 3 68. 1 70. 5 69. 7	29. 4 40. 8 51. 6 57. 3 67. 6 67. 4 65. 9	30. 7 82. 4 44. 0 51. 7 61. 3 70. 1 69. 2 67. 2 68. 8	32. 0 44. 4 54. 2 59. 2 68. 1 66. 2	31. 3 43. 1 53. 5 59. 3 68. 6 67. 6 66. 4	83 86 92 88 88	45 55 51 58 48 45 43	71 79 76 81 73 65	74 71 77 70 66
Ŋ				••••					••••		•••••		•••••	••••			•••		
Ď																			
Y			·••••		· <b>···</b> ·	· • • • • • • • • • • • • • • • • • • •	· • • • •	•••	••••	••••	••••		•••••	••••					

#### CONCORDIA, KANS.

#### [Latitude, 39° 35' N.; longitude, 97° 41' W. Local time, 1.31 slow, Eastern.]

J F M A							•••		• • • • • • • • • • • • • • • • • • •	••••			• • • • • • • • • • • • • • • • • • •	••••	•••	•••		
M J J S	28 508 28 493 28 519 28 523	28. 81 28. 73 28. 77 28. 85 28. 86	28. 11 28. 18 28. 19 28. 05 28. 17	62.8 7 68.7 63.1 8 57.6 7 41.3 6	66. 8 57. 78. 9 69. 81. 8 73. 80. 2 69. 74. 6 64. 62. 2 49.	5 70.4 8 74.6 9 71.1 5 65.6 1 50.9	101 94 97 94 87	46 52 46 46 24	82. 7 85. 0 84. 0 77. 4 65. 2	49. 0 69. 4 65. 9 60. 1 56. 2 37. 5	60, 8 65, 8 69, 3 54, 1 85, 9	67. 8 69. 5 64. 0 57. 0 39. 0	63. 0 68. 2 63. 6 56. 5 87. 8	50. 2 63. 7 67. 8 62. 6 55. 9 37. 6	93 91 91 88 82	68 58 58 46	81 85 81 76	81 81 77 74
N D Y					49. 9 40. 40. 0 82.				53. 2 43. 4	81. 5 28. 7				83. 3 27. 3				75 80

#### FORT CUSTER, MONT.

#### [Latitude, 45° 42' N.; longitude, 167° 34' W. Local time, 2.10 slow, Eastern.]

								_											_
J F M J J S O	26. 819 26. 794 26. 920 26. 791 26. 790 20. 812 26. 837 26. 898 26. 816 26. 872 26. 755	27. 18 27. 14 27. 12 27. 14 27. 06 27. 18 27. 11 27. 23 27. 12	26, 43 26, 43 26, 49 26, 49 25, 41 26, 49 20, 82	17. 7 31. 7 35. 5 43. 0 52. 5 58. 0 55. 1 48. 8 36. 1 29. 7	27. 8 48. 4 56. 3 66. 5 72. 3 81. 5 78. 4 70. 6 62. 7 50. 3	22. 1 88. 7 46. 8 56. 2 62. 1 70. 6 65. 2 58. 4 46. 9 37. 7	89. 6 46. 2 55. 2 62. 3 70. 0 66. 2 59. 1 48. 6 30. 2	58 76 87 91 100 99 96 85 72	-21 6 22 18 33	60. 0 70. 9 76. 6 87. 4 83. 9 75. 0 68. 5 54. 6	10. 8 26. 2 81. 6 88. 1 46. 5 55. 0 52. 2 45. 0 82. 6 25. 8	11. 9 26. 1 30. 1 32. 9 47. 0 49. 9 45. 4 39. 0 27. 4	18. 1 30. 2 80. 4 81. 2 49: 8 51. 3 48. 6 41. 7 81. 8	15. 7 29. 1 30. 9 85. 3 50. 4 52. 0 49. 1 40. 8 30. 6 29. 4	15. 2 28. 5 30. 5 33. 1 49. 1 51. 1 47. 7 40. 5 29. 8 28. 6	79 80 83 68 82 75 72 71 80	48 87 40 40 38 53	57 47 67 54 58 54 78	882888888888888888888888888888888888888
	26, 755 26, 824 <b>26, 82</b> 9	27. 25		28. 8	41.0	29. 5	39. 2 83. 1 46. 4	71	10 - 7 -32	54. 6 45. 2 60. 9	20. 5	<b>22.</b> 2	24.5	21. 9	22. 9	79	58	73 74 64	

COLUMBUS, OHIO.

_												[#	=8	05.	λ=	-70.	1_												_
	Not								1	Vin	d.							Prec			N	um	ber	of (	lay	<b>8</b> —	•		
自由上	8 p. m.	11 n m	11 pr 44.	Mean.	Total (miles).		Maximum.	Direction.	North.	Northeast.	East.	Southeast.	South.	Southwest.	West.	Northwest.	Calms.	Total.	Max. 24 hours.	Clear.	Fair.	Cloudy.	Rain or snow.	Max. below 32°.	Min. below 32°.	Max. above 90c.	Thunder-storms.	Auroras.	Months and year.
7. 1	7.66.65.5.66.87.6	44.54.8.3.24.4.5.6.4	1200	174 144 144 144 153 154 154 155 155 155 155 155 155 155 155	7, 2 5, 8 6, 1 5, 3 4, 3 4, 9 6, 5 68, 5	71 81 81 91 76 96 28 98	34 35 32 32 32 22 28 27 24 26 36	SW. W. SW. NW. SW. SW. NW. NW. NW.	2 5 16 7 16 18 12 4 14 12 7	4 7 10 10 8 7 11 17 9 4 9 5 101	3 8 1 12 19 8 6 9 6 4 2 3	14 15	15 9 4	19 16 18 17 21 25 17 25 20	28 20 21 5 15 12 12 12 14 7 18 17	7 7 19 13 12 6 11 14 19 18 19	0 4 2 0 0	In. 3, 75 2, 39 0, 53 4, 61 5, 83 5, 98 5, 90 2, 84 3, 11 3, 98 1, 85 42, 25	0. 20 1. 86 1. 87 2. 49 1. 31 1. 50 1. 72 0. 86 0. 77 0. 75	8 5 7 10 10 10 9 5	11 9 10 14 15 18 16 18 14 11 12 13 161	14	14 13	6	0 0 0 2	0710000	0 1 1 2 8 3 6 5 0 0 0 26	0000000	J. F. M. A. M. J. J. J. S. O. N. D. Y.
													CO 1,8			, T(		•								_			_
4.7 2.8 5.7 4.6 5.7 4.9 2.9 4.8 6.3	4.8 6.3 5.1 3.7 3.9 6.3	3.3.4.4.1.2.2	942	1.47	6, 2 6, 6 7, 0 7, 7 6, 3 6, 4 2, 3	45 02 55	36 44 81 86 85 53 45 24	W, N, N, NE., 8, NW, E, N, W,	8 11 10 0 2 1 0 1 2	16 11 19 12 14 1 1 17 6	14 16 13 19 15 9 12 18 9	1 0 5 8 10 10 11 14 1	13 17 18 23 26 61 55 34 19	11 7 21 15 5 4 5 5 1	16 16 4 9 4 1 0 3 3	5 3 2 9 2 1 2 0	9 3 0 2 7 1 8 4 4	1. 74 4. 10 2. 80 4. 50 1. 50 1. 90	0. 5: 0. 1: 0. 4: 3 1. 8: 3 1. 4: 5 2. 3: 3 1. 4: 1 0. 7: 1 . 5:	1 3 7 1	7 1 9 1 8 1 9 1	8 3 5 5 4 8 8 8 9	889693033	6 5 8 9 6 4 4 7 5	3 15 0 16 0 0 0 0 0 0 0 0	0 1 29 28 26	0 1 8 1 2 7	000000000000000000000000000000000000000	
		<u> </u>											001		-	K.A =34.		8.									,		
4.2 4.0 4.5 2.6 4.7 2.8 4.4 4.2	3.00 3.00 3.00 3.00 3.00 3.00 3.00 3.00	2332234	844 95 74 33 43 64		6, 1 5, 0 6, 8 6, 7 5, 3	48	48 29 29 23 85 29 32 48	8. 8W. 8W. 8. N. 8W. N.	16 13 8 11 6 17 8 18	3 6 14 21 9 8 4 5	9 14 12 13 15 8 19	10 23 8 14 8 9	22 18	6 7 12 4 10 9	3 4 3 4 9 6 8	21 3 5 5 8 22 17 14	3 2 6 4 1 3 7	1. 43 3. 53 2. 44	3 0. 4 0 1. 7 3 0. 8 3 2. 8 5 1. 9 1 0. 8	6 1 6 1 9 1 0 1	6 2 9 2 6 7	66 4 21 3 18 4 9 1 11 1 12 7	3 1 1 2 2 2 3 5 3 5 5 5 5 5 5 5 5 5 5 5 5 5 5	3 6 6 6 7 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6		0 11 0 11 0 0 0	1 8	00000	Ј. Ј. А. 8.
										1			CU =3,6			<b>M</b> ( =21.		T.											
5.53 5.53 5.53 5.54 5.54 5.54 5.54 5.54	157.7	5.54.4.55.52.4.4.6	7 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5	0 0 3 6 5 8 4 2 7 5 8 1	6, 8 6, 8 5, 5 5, 5 7, 1 4, 5 4, 1 5, 1 68, 9	104 108 186 148 38 104 28 771 86 70 41	48 49 86 39 55  29 82 24 60	NW. W. NW. W. NW. W.,NW N. W.	11 15 10 21 12 15 15 16 11 16 11	15 28 11 9 4	5 8 17 15 24 25 15 32 23 10 18	9 10 18 11 3 2 18 45 27	2		24 27 9 16 6 4 5 12 8 6	10 13 5 7 14 10	22 22 22 22 22 22 22 22 22 22 22 22 22	0. 1 0. 2 0. 2 0. 5 0. 6 0. 4 1. 6 0. 6 0. 2 0. 2 0. 4	8 0. 0 6 0. 0 4 0. 1 1 0. 1 7 0. 2 8 1. 8 5 0. 2 0 0. 9 8 0. 2 4 0. 1 4 0. 1 9 0. 0	8 2 7 2 4 1 2 9 5 3	4	14 1 17 14 16 20 20 8 14 11 11 20 18	7 9 8 6 7 4 3 4 3 9	7 1 4 8 6 1 9 7 7 2 4 4		5 6 3 0 0 1 0 4 6	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0		M. A. M. J. J. A. S. O. N. D.

#### DAVENPORT, IOWA.

[Latitude, 41° 30' N.; longitude, 90° 38' W. Local time, 1.02 slow, Eastern.]

	Pr	<b>688</b> 1170.				Тег	npers			1	Dew p	oint.		h	tela um	tivi	y.		
year.										Me	an.				-				
Months and	Mean.	Maximum.	Minimum.	7 p. m.	8 p. m.	11 р. m.	Mean.	Maximum.	Minimam.	Maximum.	Minimum.	7 p. m.	3 p. m.	Пр. ш.	Mean.	7 a. m.	3 р. ш.	11 p. m.	Менв.
J F M A. M J S O D	In. 29, 482 29, 363 29, 420 20, 376 29, 376 29, 378 29, 378 29, 378 29, 378 29, 378 29, 376	29. 70 29. 56 29. 66 29. 55 29. 67 20. 50 29. 64 29. 68 29. 93	In. 28, 52 28, 84 28, 96 28, 89 29, 00 29, 01 28, 70 28, 80 28, 62 28, 52	51. 3 63. 1 69. 5 62. 8 57. 2 42. 7 33. 7 21. 8	65. 8 74. 7 83. 5 74. 7 70. 3 55. 5 43. 4 29. 8	49. 4 56. 3 66. 7 73. 5 66. 9 61. 6 46. 3 87. 1	16. 9 17. 3 34. 3 49. 4 57. 8 68. 2 75. 5 68. 0 48. 2 38. 1 25. 6	46 60 74 85 87 97 90 83 76 64 50	-17 8 28 29 46 55 48 45 29 23	42. 8 58. 0 68. 4 77. 7 85. 5 77. 7	7.9 26.0 41.9 48.6 59.5 66.1 59.7 55.4 41.1 31.6 18.2	5. 7 5. 4 21. 9 37. 6 43. 9 57. 0 63. 3 57. 4 52. 7 37. 5 30. 0 18. 2 35. 9	0 10.9 12.9 26.7 41.8 42.7 56.7 63.6 55.7 31.6 20.2 37.8	0 10.7 10.8 25.6 41.6 47.4 59.1 65.5 60.0 55.3 38.0 32.2 20.8 38.9	9. 1 9. 7 24. 7 40. 3 44. 7 57. 6 64. 1 58. 0 53. 3 37. 7 31. 3 19. 7 37. 5	77 81 81 84 85 83 86 86	64 66 62 64 46 56 52 55 55 55 55 55	76 69 75 73 77 77 79 81 74 83 83	71 72 68 72 65 71 70 73 71 78

#### DAVIS FORT, TEX.

[Latitude, 30° 38' N.; longitude, 108° 56' W. Local time, 1.56 alow, Eastern.]

				i				1	$\neg$									$\neg \tau$	$\neg$
J	<b>2</b> 5. 192	25. 44	24. 90	83. 9	49.6	38. 9	40.8	72	5	53. 6	28.0	25.0	25. 4	25, 4	25, 3	72	45	61	50
F	25. 109	25, 42	24. 82	37. 8	58. 9	47. 0	47. 9	75	17	62. 3					24. 4			45	44
М	25. 222								31		41.5				36.4		43	65	61
Α	25, 138	25. 32	24.97	52. 0	72. 2	60. 5	61.6	84	87		49. 6		84. 3	38, 2	36.7	60	27	47	44
М	25, 122	25. 27	24. 91	54. 5	75. 2	63. 7	64. 5	90	44	79. 0			40.7	48.0	42.6	72	34	53	
J	25, 201	25, 31	25. 01	66.7	85. 9	72. 7	75. 1	98	59	90.4	64.5	51. 4	47.7	53.8	51.0	61	31	55	49
J	25. 241		25. 16						58	88, 3	63. 7	56.2	54.7	57. 0	56.0	75	40	60	58
Α	25. 231								56	88. 3	63.4	55. 1	52.8	55.8	54.6	72	39	62	
8	25. 225								50	83, 1	57. 5	50. 8	48.3	52. 2	50.4	77	37	60	58
0	25. 230								35	75.7	47.4		35. 8						51
N	25, 200								25				27.8					42	41
D	25.219								17	62.8	34. 8		23.1			58	28		45
Y	25. 194	25. 48	24. 75	50. 9	70. 5	58. 4	59. 9	98	5	74.6	48.2	39. 4	37. 5	40. 2	39.0	68	34	54	52
				1	ŀ	1		٠ ا									_1	- 1	_

#### DAYTON, WASH.

[Latitude, 46° 19' N.; longitude, 117° 56' W. Local time, 2.52 alow, Eastern.]

#### DEADWOOD, DAK.

[Latitude, 44° 23' N.; longitude, 103° 43' W. Local time, 1.55 alow, Eastern.]

J F M A	25, 261 25, 232 35, 402 25, 318	25, 50 25, 60 25, 61	24, 78 25, 18 24, 96	18. 6 29. 1 36. 0	25. 8 38. 4 47. 5	21. 0 31. 8 40. 4	21. 8 33. 1 41. 3	56 53 65	-15 7 21	31.0 41.6 51.0	13. 6 25. 8 33. 5	13.5 22.6 29.3	16. 1 25. 3 82. 6	14. 6 24. 5 32. 5	24. 1 31. 5	77 77 77	68 61 60	77 75 74	74 71 70
M J J S	25, 350 25, 405 25, 438 25, 473 23, 406	25. 70 25. 63 25. 70	24. 74 25. 11 25. 15	51. 3 59. 2 54. 1		57. 0 63. 8 58. 6	57. 4 65. 5 60. 2	81 90 85	35 45 39	76. 8 71. 2	48. 5 55. 8	45. 9 51. 1 47. 6	51. 6 52. 6 49. 6	50. 7 54. 7 50. 7	49. 4 52. 8	82 75 80	59 67 51 57 60	81 73 77	77
O N D Y	25, 425 25, 299 25, 324 25, 361	25. 70	25. 06 24. 89	40. 1 36. 1 30. 6	52. 9 47. 8	42. 7 39. 1 30. 9	45. 2 41. 0 33. 3	76 <b>63</b> 58	18 15 - 2	55. 9 50. 5 41. 7	35, 0 31, 4 24, 1		36. 1 34. 8 24. 6	33. 1	33. 9 32. 0 23. 1	75 79 72	56 63 58	69 74 78	67 72

DAVENPORT, IOWA.

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					( <i>H</i> :	= 61	5.	À=	77.	1	•											
Cloudiness (in tenths).			w	ind.							Prec tati	dpi- on.		Nu	ımb	er	of	day	78	•		
7 a. m. 8 p. m. 11 p. m. Mean.	Total (miles).	Direction.	North.	East.	Southeast.	South.	Southwest.	West	Northwest.	Calma.	Total.	Max. 24 hours.	Clear.	Fair.	Cloudy.	Rain or snow.	Max. below 320.	Min. below 82°.	Max. above 90°.	Thunder-etorme.	Auroras.	Months and year.
2 5 5 8 4 1 4 4 5 7 4 9 6 1 1 4 9 7 5 2 4 5 6 5 4 3 5 5 5 4 5 6 5 1 4 9 6 5 3 6 5 6 5 6 5 6 5 6 5 6 5 6 5 6 5 6	6, 738 28 5, 436 26 7, 750 34 6, 116 34 4, 620 3 5, 573 44 5, 528 26 5, 135 34 4, 570 30 5, 164 28 68, 878	N. W. SW. W. SW. SW. SW. SW.	4 10 8 13 5 12 6 8 12 10 7 7 13 8 7 16 13 9 8 9 12	11 16 18 3 15 16 15 7 7	5 9 10 8 7	8 8 11 6 17 11 10 12 9 8 9	25 8 16 12 7 17 81 12 19 12 10 22 191		24 17 30 19 27 11 8 18 9 16 24 15 218		In. 2. 10 1. 20 0. 17 2. 47 1. 94 2. 08 1. 66 12. 68 4. 19 2. 71 1. 20 1. 95 34. 35	0. 86 0. 10 0. 86 0. 77 0. 53 0. 72 4. 79 1. 52 1. 07	7 0 6 6 8 10 9 7	12 11 17 15 17 18 18 17 10 11 12 17	6 7 15 8 6 7 6 10 11 11 7	15 16 12 10 11 10 9 6	00000	29 26 21 3 1 0 0 4 17 25 126	00000700007	0 1 5 6 9 5 1 0	000000000000	J. F. M. A. J. A. S. O. N. D. Y.
			· · ·			IS 1 = 4,1							·						·			_
4.14.43.44.0 1.62.81.52.0 3.85.32.63.9 3.14.52.83.9 4.24.93.04.3 2.85.61.93.4 2.85.61.93.4 2.85.61.93.2 0.2.81.32.0 1.02.81.32.0 1.02.81.32.0 1.02.40.51.5 3.04.32.2	5, 671 3 5, 507 3 5, 285 4 5, 818 3 5, 012 2 4, 866 2 4, 423 3 3, 961 4 3, 937 2 5, 145 3 5, 883 3 60, 079	8 SW. 0 SW. 3 SW. 7 NE. 9 NE. 2 E. 9 N. 8 SW. 2 SW.	6 2 3 1 6 2 2 1 3 1 3 1 8 2 6 3 5 2 8 1 5 2 8 1 5 2	1 8 2 5 4 6 6 11 16 16 18 18 5 5 1 1 8 2	4 2 4 0 3 12 6 5 1 1	4 9 4 7 11 10 6 7 3 8 4 5	41 46 82 51 33 28 27 16 15 29 45 47	4 9 7 10 7 14 14	3 3 0 3 2 2 1 4 10 6 4 4 4 4 2	7 3 12 1 9 4 7 7 9 11 16 8	0. 28 1. 28 0. 46 1. 97 1. 17 2. 50 3. 34 1. 58 0. 70 0. 01	0, 31 0, 23 0, 86 0, 30 0, 86 0, 55 1, 23 1, 01 0, 53 0, 01 0, 20 1, 23	18 11 19 12 16 12 20 22 21 23	14 16 7 12 14 14 10 7 9	1 6 3 5 6 1 5 0 0	4 2 8 6 12 7 11 14 5 6 1 2 78	0 0 0 0 0 0 0 0 0	0 0 0 4 11	0 0	1 0 2 4 8 8 8 9 1 0 0 41	000000000000000000000000000000000000000	J. F. M. A. M. J. A. S. O. N. D. Y.
						TO:			SI:	τ.					-							
6, 47, 65, 36, 4 6, 17, 56, 46, 7 6, 17, 56, 46, 7 1, 12, 71, 82, 2 1, 92, 72, 62, 4 1, 4, 86, 25, 4 2, 82, 32, 62, 6 1, 90, 81, 100, 9 3, 23, 52, 23, 0 2, 62, 91, 62, 7 4, 7, 91, 62, 7 4, 7, 91, 65, 6	3, 846 18 3, 244 20 3, 651 18	SW. SW. SW. SW. SW.	5 9 4 4 4 11 11 2 8 13 5 6 8 4 4 2 7 17 18 9 6	5 18 11 13 4 6 11 5 3	0 2 9 12 6 8 7 17 13 11 8	0 11 5 7 9 7 6 5 0 3 11	36 48 28 32 38 32 35 34 42 23 40	4 2 7 8 4 9 16 5 6 7	1 1 1 0 1 3 2 4 5 2 3 2 2 3 2	7 4 9 2 14 11 7 6 8	2, 29 0 3, 74 1 0, 05 0 0, 06 0 3, 08 1 2, 20 0 0, 07 0 1, 15 0 1, 23 0 2, 71 1	. 07 . 04 . 04 . 28 . 57 . 01 . 05 . 63	20 16 9	13 16 15 8 5 8	2 1 3 1 6 8 1 3 0 3 4	63229911388344	14 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	25 9 5 6 0 0 0 0 0 4	0 0 0 0 0 10 13	0 0 0 0 2 2 0 0	0 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	J. F. M. A. M. J. A. S. O. N. D. Y.
						DW 4,60			DA = 52													
4.0 5.2 2.0 4.1 5.16.54.15.2 4.86.0 2.64.7 4.64.7 3.7 4.3 3.36.15.8 5.1 3.14.3 2.9 3.4 1.94.0 2.6 2.8 2.94.3 1.8 2.8 2.24.2 1.8 2.8 3.04.7 2.5 3.4 2.4 4.9 2.9 3.7	2, 451 15 2, 331 16 3, 276 18 2, 822 20 3, 673 25 3, 402 18 3, 217 20 2, 901 16 1, 724 16 2, 352 24 1, 661 30	E. NE. NE. SW. SW. SW. SW. SW. SW. SW. SW. SW. SW	2 19 1 27 4 35 4 36 2 31 4 37 3 39 1 46 2 35 4 13 3 20 34 373	7 8 6 2 4 6 7 6 2 5	6 1 2 5 1 5 6 4 0 5 0 40	3 4 4 7 10 5 3 7 5 6	42 26 27 24 21 22 29 23 35 18 38 38 33 138	9 10 8 7 7 3 3 5 1 7 8 8 76	1 1 2 2 4 2 1 1 0 2 2 2 2 2 2 2 0 2 2 2 2 2 2 2 2	8 3 2 18 3 2 1 0 20 9 26	1, 60 2, 88 3, 31 3, 11 3, 22 4, 83 1, 44 2, 92 0, 90 1, 69 1, 18 28, 48	0. 64 0. 55 1. 97 0. 87 1. 15 0. 56 1. 04 0. 58 1. 11 0. 49 0. 40	5 11 13 12 8 15 18 19 19 17 16	16 17 14 16 16 15 10 7 9 10 10	733 3 613 4 335	19 12 14 15 18 8 13 6 4 6	14 4 0 1 0 0 0 0 0 0 0 6		000000000000000000000000000000000000000	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0 1 0 1 0 1 0 0 1 0 0 0 0 0 0 0 0 0 0 0	F. M.

#### DELAWARE BREAKWATER, DEL.

[Latitude, 38° 48' N.; longitude, 75° 10' W. Local time, 0.00, Eastern.]

	Pr	esure	•			Te	шрег	stur	ъ.	_		1	Dew 1	point.			lole ami		
year.		1								Me	an.								
Months and	Mean.	Maximum.	Minimum.	7 a. m.	8 p. m.	11 p. m.	Меап.	Maximum.	Minimum.	Maximum.	Minimum.	7 a. m.	8 p. m.	11 р. т.	Mean.	7 a. m.	8 p. m.	11 p. m.	Mosn.
Ј F М.	In. 30, 118 29, 977	In. 30. 83 30. 51	In. 29. 37 29. 18	o 34. 1 26. 8		o 34. 5 27. 7	o 35. 3 28. 4	63 52	0 12 9	o 48, 2 35, 4	27.6 22.7	28. 7 20. 4	o 27. 7 22. 0		o 28. 3 21. 2	81 77	<b>60</b> 70	79 76	76 75
<b>A</b>																			
J ▲ 8	•					• • • • • • • • • • • • • • • • • • •				· · · · ·									•••
O N D Y	•															•••			•••
1	•••••	•••••			••••	••••	• • • • • •	•••	••••	• • • • •	•••••		••••	••••	•••••				•

#### DENVER, COLO.

[Latitude, 39° 45' N.; longitude, 106° W. Local time, 2.00 alow, Eastern.]

J M . M . J J	24. 671 24. 620 24. 787 24. 668 24. 720 24. 773 24. 836	24. 99 25. 06 25. 01 25. 00 25. 08	24. 27 24. 58 24. 27 24. 46 24. 24	26. 9 29. 0 37. 8 48. 9 52. 7	88. 0 48. 2 53. 9 61. 2 74. 9	32. 2 38. 3 45. 5 58. 0 68. 7	82. 4 89. 5 45. 7 52. 7 68. 8	60 68 71 86 86	0 5 18 27 41	44. 4 52. 6 58. 4 64. 4 78. 4	16. 7 20. 9 26. 1 85. 4 41. 9 51. 2 58. 6	17. 4 20. 6 30. 4 36. 6 48. 1		20. 4 24. 4 82. 9 87. 0 48. 4	19.8 21.6 30.7 35.8 41.4	71 76 77 71	57 40 48 40 80	66 60 60 51	57 62 59
A 8 N D Y	24. 846 24. 797 24. 815 24. 009 24. 738 24. 747	25. 08 25. 05 25. 04 25. 06	24. 87 24. 48 24. 10 24. 15	50, 7 39, 9 85, 3 29, 0	72.6 60.7 53.5 45.7	62. 5 47. 2 39. 8 33. 8	61. 9 49. 8 42. 9 36. 2	90 80 75 74	42 22 11 - 6	76. 0 64. 4 57. 0 48. 7	55. 7 49. 6 87. 0 80. 8 24. 2 87. 8	40. 1 29. 1 24. 5 18. 7	20.0	44. 0 83. 5 28. 8 20. 8	41.9 80.8 25.9	69 68 67 66	36 36 42	55 61 65 68	54 55 56

#### DES MOINES, IOWA.

[Latitude, 41° 35'N.; longitude, 93° 87' W. Local time, 1.14 slow, Eastern.]

J	20 238	29.76	29 51	7.6	15.6	11.2	11 5	47	-20	10 1	9 1	0.5	6, 2	4.5	87	79	66	72	70
F	29, 139	29.60	28.61	10.0	10. 1	14.6	14.6	50	-20		6.0	20	9. 5	7. 9	6.8	72	66		71
М.		29, 52									25. 5	20.8	26.0	26. 8	24.4	75	58	74	
Α		29.45											42.0						75
М.		29.34									48.8		48.2						68
Į		29.40									60.4		62. 2						77
J	29. 066	29. 32	28. 62	68. 6	84. 1	74. 9	75, 9	100	54	88. 5	66. 7	64.8	67. 8	68. 1	60.0	86	58	80	75
<b>A</b>	29, 094	29. 42	28. 81	61.8	76.9	67. 6	68.8	90	46	79. 7	60.4	58. 2	61. 5	62. 2	60.6	88	∞	83	77
8	29. 103	29. 41	28. 51	57. 1	70.6	62.7	<b>63.</b> 5	87	45	73. 0	55. 6		55.6					88	78
0		29.45									40. 5		42. 1						75
<u>N</u>		29. 42									82.2		83. 7						
<u>D</u>		<b>29</b> . 63									20.6		28.7			84	60		
Y	29. 115	29.76	28. 43	40. 9	53. 4	46.1	46.8	100	-20	56.8	38. 3	36.0	39. 8	39. 7	38. 5	82	62	78	74
		1 1	1		, ,		1		1									- 1	- 1

#### DETROIT, MICH.

[Latitude, 42° 20' N.; longitude, 83° 8' W. Local time, 0.32 slow, Eastern.]

J M J J O ND	29. 347 29. 254 29. 325 29. 321 29. 222 29. 316 29. 269 29. 267 29. 269 29. 269 29. 269 29. 269 29. 269	29. 81 29. 68 29. 52 29. 57 29. 53 29. 58 29. 61 29. 64 29. 69 29. 95	28, 50 28, 68 28, 71 28, 82 28, 99 28, 73 28, 82 28, 75 28, 86	11. 3 21. 5 40. 6 52. 1 66. 4 68. 9 62. 7 57. 4 46. 3 39. 8 30. 9	21. 5 30. 3 50. 2 62. 4 72. 4 81. 3 71. 5 68. 6 55. 2 44. 3 35. 5	17. 1 26. 8 44. 4 55. 9 64. 8 73. 8 65. 8 62. 0 50. 4 42. 8 32. 4	16. 6 26. 2 45. 1 56. 8 65. 9 74. 7 62. 7 50. 6 42. 1 32. 9	50 55 77 80 87 90 86 81 72 67 55	-12 - 2 20 30 44 54 48 41 28 29	27. 4 84. 5 54. 1 65. 7 75. 8 83. 9 74. 2 70. 8 58. 1 47. 7 39. 8	6. 8 18. 1 36. 8 48. 8 56. 4 64. 9 50. 3 54. 9 43. 7 37. 1 26. 5	2. 1 18. 9 82. 4 44. 6 58. 5 62. 2 58. 1 51. 5 42. 2 35. 7 26. 7	18. 6 12. 5 22. 2 88. 8 48. 4 57. 7 65. 4 60. 0 53. 4 43. 7 37. 6 28. 5 42. 6	9.5 18.9 35.8 46.1 56.2 64.9 59.7 58.2 44.2 37.8 27.6	8.0 18.3 85.7 46.4 55.8 64.2 59.8 52.7 43.4 87.0 27.0	72 78 77 78 89 85 81 86 86 84	66 62 61 59 68 68 78 76	73 71 72 70 74 74 81 74 89 84 83	77 70 71 71 71 71 88 SI
¥	29. 286	29.95	28. 45	42. 6	51.7	46. 5	48. 9	90	-12	56, 2	XQ O	36. 1	47.8	39. 0	38. 0	78	67	75	74

# Monthly and yearly motocrological summarice—Continued. DELA-WARE BREAK-WATER, DEL.

[H=20, A=96.]

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		حثا نند					W	ind	d.							Pre			Nt	ımb	er (	of d	lay	<b>8</b> —			_
, ii.	8 p. m.	11 p. m.	Mean.	Total (miles).	Maximum.	Direction.	North.	Northeast	East.	Southeast.	South.	Southwest.	West.	Northwest.	Calms.	Total.	Max. 24 hours.	Clear.	Fair.	Cloudy.	Rain or snow.	Max. below 32°.	Min. below 32°.	Max above 900.	Thunder-storms.	Auroras.	Months and wear
ا و	5.3	4. 4	5.3	13, 476 12, <b>2</b> 07	53	SE. NR.	8 10	16 14		6	13	18	8	29 36	0		In. 0. 97 0. 97				12		18 24	0		00	J.
	•••			12, 20					5							1. 91					11	11			::		Į A
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										•••	-;-															١١	J
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	•••					•••••		• • •		•••		•••		•••								$\left  \cdot \cdot \right $					Ÿ
				·							ENV ≃5,		•	OL =8										,			_
			3.7			W.	12	9	2	4	32	13	14	7	0		0. 24			5	3		28	0	0	0	J
8)	4.0	2	4.3	5, 547	7 86	W.	23	9	4	5	31	4	19	6	0	0.97	0.39	14	14	3	8	0	21 25	0	0	0	M
0)	6.3	4.3	5. 6	5, 00	7 28	NW.	19	11	5	8 9	25 23		9	9	1	2, 13	2. 77 0. 92	6		10	17	0	9	0	4	0	M
9	4:0	5.4	4.4	5, 07	7.44	S. SW.	15 16	10	6	14	38	16	4	12	0	1, 33	0.38	0	18	3	15	0	0		15	0	J
78	3,6	13.	14.2	4, 56	1 36	NW.	21 19		6	7	27 36	10	6	10	2	1.22	0.38	14	13	5	16	0	0	0	8	0	AS
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3	5, 5	3.4	75.5	6, 54	$\frac{728}{132}$	SW.	8 12	14	6	- 5	14	25	12	3		1, 20	0. 68 3 0. 24	12	- 8	8	13	18 11	26 26	0	0		F
					or or	874	10	17	6	12 4	14 25	11	13 11	11	0	1. 83	10.75	5	10	9	12	0	8	0	3		A
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DODGE CITY, KANS.
[Latitude, 37° 45' N.; longitude, 100° W. Local time, 1.40 slow, Eastern.]

	Pr	.07.IJ 000	<u>_</u> -		24.3	_ <u>_</u> _	nper	tur	<b>8.</b>			]	Dew p	oint.			enid umid		
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Months and year.	Mean.	Maximum.	Minimum.	7 A. III.	8 p. m.	11 p. m.	Moan.	Maximum.	Minimum.	Maximum.	Minimum.	7 a. m.	8 p. m.	11 p. m.	Mean.	7 a. m.	8 p. m.	11 p. H.	Konb.
J F M J J S O D	In. 27. 478 27. 889 27. 496 27. 863 27. 891 27. 404 27. 418 27. 408 27. 437 27. 361 27. 409	In. 27. 87 27. 77 27. 72 27. 72 27. 65 27. 72 27. 55 27. 71 27. 72 27. 74 27. 74	In. 26, 75 26, 91 27, 10 27, 15 27, 12 26, 94 27, 18 27, 18 27, 18 27, 18 26, 68 26, 68	0 12.8 19.0 81.0 44.9 51.1 63.4 65.8 57.9 41.5 87.4 81.0	76. 1 63. 6 55. 7	89. 9 53. 1 57. 5 70. 2 74. 8 72. 1 68. 9 48. 8 42. 6 83. 9		75 79 84 95 97 95 88 83 75		27. 4 38. 0 55. 8 68. 2 71. 0 83. 4 88. 7 85. 2 78. 5 65. 6 57. 6 46. 9	49. 2 61. 8 67. 1 64. 5 56. 6 39. 9 85. 1 27. 8	9. 6 14. 8 27. 2 89. 9 47. 0 57. 7 64. 2 60. 4 54. 5 36. 9 25. 9 39. 1	21. 8 80.7 87. 1 49. 1 58. 5 65. 7 61. 4 54. 9 85. 8 81. 2	0 14. 4 19. 0 80. 4 89. 1 50. 5 66. 7 62. 5 55. 7 88. 2 83. 5 29. 4	29. 4 8R. 7 48. 9 59. 0 65. 5 61. 4 55. 0 81. 9 28. 9	84 86 83 86 83 86 85 89 83 78	76 62 48 38 54 51 51 51 51 52 62 53	86 71 62 79 74 77 76 69 72 84 75	20 76 61 78 62 72 65 72 71 65 77 71
		[Latit	ude, 4	20 <b>8</b> 07	N.; 1					OWA		me, 1.0	S elor	v, Ra	atern	.]			
J F M J A 8 O Y	29. 405 29. 295 29. 277 29. 208 29. 289 29. 248 29. 274 29. 301 29. 283 29. 255 29. 330 29. 293	29. 97 29. 81 29. 71 29. 63 29. 48 29. 69 29. 49 29. 63 29. 55 29. 54 29. 54 29. 54 29. 54 29. 54 29. 57	28. 50 28. 74 24. 81 28. 92 28. 83 29. 00 28. 96 28. 69 28. 73 28. 55 28. 55	6.6 6.8 24.6 42.1 49.7 61.1 68.0 60.4 55.4 40.8 83.2 21.3 89.2	52. 5 65. 8 78. 7 82. 0 78. 8 69. 8 54. 6 42. 8 29. 4	13. 0 13. 3 80. 6 47. 0 55. 2 65. 2 71. 8 64. 9 60. 0 45. 0 86. 7 24. 2 43. 9	12 3 13. 3 80. 3 47. 2 56. 7 66. 7 73. 8 66. 4 61. 7 46. 8 87. 6 25. 0 44. 8	48 60 74 86 88 97 86 86 77 62 51	-22 -20 - 1 25 26 44 52 46 42 28 19 - 9	21. 1 23. 0 89. 0 55. 8 68. 6 77. 2 84. 6 76. 3 71. 4 56. 6 45. 7 82. 8 54. 8	57. 9 64. 8 57. 9 58. 8 89. 1 80. 8 17. 2	- 8.1 - 2.4 16.4 36.5 42.8 55.4 62.7 55.9 51.8 36.8 28.9 17.0 32.7	87. 6 42. 1 56. 5 65. 0 57. 5 52. 5 88. 8 81. 8	- 2. 1 2. 7 19. 9 88. 8 44. 9 57. 5 65. 6 59. 1 54. 8 88. 6 31. 2 19. 7 85. 9	57. 5 52. 7 87. 6 80. 5	65 71 80 76 82 83 85 87 86 84	56 58 56 56 57 65 78	58 64 72 69 77 83 82 82 79 81 83 74	50 68 61 71 64 72 75 75 75 75 76 89 70
		(Lati	tude, 4	<b>6</b> 0 48	N.:					IINN Lo		me, 1.0	rofa 8	v, Be	storn	.1			
J M J SON Y	29. 318 29. 249 29. 318 29. 268 39. 183 29. 179 29. 240 29. 251 29. 245 29. 269 29. 250	29. 89 29. 75 29. 72 29. 61 29. 60 29. 46 29. 63 29. 53 29. 55 29. 61	28. 61 28. 74 28. 70 28. 70 28. 72 28. 85 28. 73 28. 86 28. 54 28. 74 28. 75	- 6. 6 - 2. 2 11. 6 82. 5 43. 2 53. 7 62. 1 56. 6 49. 2 87. 8 29. 2 15. 8	5. 4 12. 0 24. 1 41. 5 51. 9 61. 8 70. 7 66. 4 59. 3 46. 4 35. 0 23. 4	- 0. 4 5. 0 17. 2 86. 4 45. 8 56. 8 63. 7 59. 5 53. 1 40. 8 81. 5	- 0. 5 4. 9 17. 6 86. 8 47. 0 57. 3 65. 5 60. 8 53. 9 41. 7 31. 9 19. 2	40 40 47 72 78 86 94 81 82 68 43 44	-41 -82 -17 5 27 83 49 44 88 25 20 -20	8. 8 14. 9 26. 8 46. 8 56. 1 66. 6 74. 1	-12. 3 - 6. 1 7. 8 27. 8 88. 7 48. 6 50. 6 54. 0 47. 1 35. 8 28. 2 11. 9	-12.0 -7.5 5.9 24.8 83.9 46.8 58.7 49.8 43.1 81.8 25.6	- 8, 9 8, 2 16, 2 25, 9 81, 0 44, 2 53, 2 51, 0 43, 4 81, 5 28, 3	- 7. 1 - 1. 1 10. 7 24. 9 83. 1 45. 5 52. 9 51. 2 43. 9 28. 0	- 7. 7 - 1. 8 10. 6 25. 6 32. 7 45. 8 50. 7 43. 8	77 78 78 77 70 77 70 77 70 77 80 78 78 80 80 80 80 80 80 80 80 80 80 80 80 80	58 49 59 60 60 70	73 75 75 64 63 70 75 78 78 86 80 73	72 74 75 61 61 67 71 71 70 83 77
		[Lati	tude, 4	40 54	N.;	longi	EAS ude,			•		ime, 0	.82 fa	st, Es	ster	.]			
J M M J S O Y	29. 875 29. 779 29. 844 29. 862 29. 909 29. 813 29. 874 29. 904 28. 954 29. 808 29. 808 29. 808	80, 85 80, 48 80, 26 80, 13 80, 17 80, 17 80, 80 80, 30 80, 32	28, 94 29, 14 29, 32 29, 12 29, 25 29, 48 29, 52 28, 69 29, 20 29, 34 28, 85	14. 8 20. 1 87. 7 45. 8 54. 9 60. 2 57. 4 52. 3 46. 3 37. 6	26. 4 44. 1 52. 9 61. 1 67. 5 66. 0 59. 8 51. 0 41. 7	18. 7 22. 0 87. 7 43. 9 52. 2 57. 2 56. 9 51. 2 46. 3 38. 4	18. 5 22. 8 39. 8 47. 5 56. 1 61. 6 60. 1 54. 4 47. 9 27. 8	43 48 48 60 73 78 75 71 71 61 57 57 53	-11 - 5 23 31 39 49 45 88 29 24	26. 0 28. 5 46. 0 54. 9 63. 7 69. 9 67. 8 61. 6 53. 3 44. 6	11. 4 15. 9 33. 9 40. 1 48. 0 53. 5 53. 4 47. 1 42. 0 33. 8 18. 8	7.1 18.0 28.1	16.6 29.6 40.5 48.8 7 55.6 2 54.6 3 49.7 1 42.6 1 31.5 7 22.6	15. 29. 88. 46. 53. 47. 47. 42. 33.	1 15. 1 29. 2 39. 3 47. 2 54. 9 53. 7 48. 2 42. 2 32. 1 21.	2 7	U 67	78	78 73 73 74 74 79 80 82 77 77 70

# Monthly and yearly meteorological summaries—Continued. DODGE CITY, KANS. [H=2517. A=87.]

Cl (in	ou te	din	eas hs).					W	7ind	1.							Prec			N	mb	er	of d	lay	9—		
7 a. m.	3 p. m.	II p. m.	1 3		Total (miles).	Maximum.	Direction.	North.	Northeast.	East,	Southeast.	South.	Southwest	West.	Northwest.	Calms.	Total.	Max. 24 hours.	Clear.	Fair.	Cloudy.	Rain or snow.	Max. below 32°.	Min. below 32°.	Max. above 90°.	Thunder storms.	Months and year.
3.1 3.8 3.8 4.5 5.1 4.0 4.7 3.2 1.3 3.5	4.64.224.73.4.73	22344232233	12.63.64.5.74.32.2.94.633.	3 5 1 1 0 7 4 8 8 8 1	8, 69 7, 87 9, 12 8, 07 6, 65 7, 24	3 36 8 46 3 63 9 58 37 52 8 35 3 38 9 51 4 42 52 40 40 48	N. N. SE. SE. SE. S. NW. NW. W.	6 17 17 14 8 7 7 14 10 20 6 14 140	14 7 11 9 8 1 4	3 6 4 10 12 7 10 6 0 10 3	222 5 6 34 26 36 43 28 36 13 16 11 276	7 8 7 17 12 14 18	6	22 19 17 3 13 5 2 3 5 7 12 15 123	5 6 8 21 20 20		0. 47 0. 75 1. 39 4. 07 2. 02 6. 03 1. 80 3. 48 1. 06 0. 36	In. 0. 25 0. 39 0. 27 0. 79 0. 98 0. 47 2. 19 0. 81 1. 47 0. 79 0. 36 0. 58 2. 19	13 11 7 8 14 14 18 22 12 16	16 16 18 14 15 13 8 12 10	2 3 6 8 2 4 4 1 6 5 46	4 5 9 19 10 9 7 8 4 2 7	000000000000000000000000000000000000000	31 27 21 0 0 0 0 0 0 0 3 7 18	6 12 11 0 0 0	00059574500035	0 J. 0 F. 0 M 0 J. 0 J. 0 A 0 S. 0 O. 0 D 0 Y
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4.5 7.0 4.3 4.7 5.5 4.2 8.8 7.2	5. 0 5. 5 7. 4 5. 7 5. 6 5. 6 6. 9 7. 1	3464844 4 56	9 4. 3 6 4. 4 6 5. 6 5 7. 6 6 4. 7 6 4. 7 6 4. 6 6 5. 8 6 6. 2 6 5. 2	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	4, 20 3, 38 3, 13	6 16 8 26 6 18 5 24 6 26 7 24 9 14 9 16 2 16 8 16	NW. W. S., SE. W. NW. NW., N. S. (NW., N. S., NE.	6 11 5 10 7 3 4 8 6 8 7 9 84	11 2 7 8 3 5 8	3 2 3 3 3 6 3 2	4 6 5 11 8 17 14 17 10 7 9 7 115	222 7 9 21 15 18 20 10 13 16 8 13 172	10 8 11 2 6 11 11 4 9 2 6 8 8 88	20 15 21 6 12 12 10 11 7 8 13 11 146	23 14 20 15 15 19 11 13 14 28 20 18 210	8 7 5 14 19 25 13 16 24	0. 72 0. 41 3. 69 2. 62 6. 16 6. 35 8. 02 4. 58 2. 32 0. 64	1. 24 0. 28 0. 22 1. 20 1. 26 2. 32 1. 58 3. 38 1. 26 0. 81 0. 44 1. 46 3. 38	9 9 8 7 13 12 10 3 6	13 15 14 16 18 15 9 10 11 15 13	7 14 6 4 9 9 8 10 12 12	8 6 16 13 15 15 12 13 10	8 0 0 0 0 0 0 1 12	26 5 1 0 0 0 0 5 15 25	000050000000000000000000000000000000000	0 0	0 J 0 F 1 M 0 J 0 J 0 A 0 S 0 O 0 N 0 D
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1.76 1.05 1.55 1.55 1.05 1.05 1.05 1.05 1.05	5.1 5.7 5.1 5.9 8.1 9.2 9.2 9.2 9.3 9.3 9.3 9.3 9.3 9.3 9.3 9.3 9.3 9.3	4.4	5.4265.5.5.5.5.5.5.5.5.5.5.5.5.5.5.5.5.5.5.	10 80	8, 05 7, 75 8, 76 5, 24 5, 79 2, 98 4, 27 5, 03 1, 84	3 45	E. SE. NE., E. E. E. S. SE. SE. NE.	5 13 17 13 8 6 5 9 10 16 17 16 135	9 8 7 10 4 1 1 1 1 6 6 1 8	10 1 7 4 4 2 3 8 12	1 2 2 2 2 0 3 1 5	14 22 28 34 39 35 25 26 8	7 4 7 8 9 9 9 8 22 11 12 15	15 12 4 6 11 2 6 8 3 12 11	25 22 9 9 16 15 13 24	2 8 8 8 8 8 8 9 15 15 15 15 15 15 15 15 15 15 15 15 15	2. 94 5. 94 5. 35 4. 75 4. 66 1. 96 4. 26 3. 66 5. 96 4. 76 4. 76	5 2. 62 8 1. 77 0 1. 91	9 4 6 9 8 12 8 12 13 14 15 15 15 15 15 15 15 15 15 15 15 15 15	10 19 14 14 14 16 16 16 11 13 11 15 17 17 18	9 9 8 7 7 5 8 8 8 5 5 4 4 4 1 1 0 8 8 1 5 1 5 8	10 11 11 11 11 11 11 11 11 11 11 11 11 1	1 0 7 0 9 0 2 0 7 0 1 0 2 0 8 13	28	8 00 00 00 00 00 00 00 00 00 00 00 00 00	0 1 0 1 1 1 0 0 0	3 M 2 M 2 M 2 M 2 M 2 M 2 M 2 M 2 M 3 M 6 M 3 M 6 M 1

ELLIOTT, FORT, TEX.

[Latitude, 85° 80' N.; longitude 100° 27' W. Local time, 1.41 alow, Eastern.]

	Pr	- COURT			24., 2		npera	tur	0.			1	Dow 1	oint.		1	lele —		<b>7.</b>
Months and year.		um.	am.					am.	am.	Me								ن	
Month	Mean.	Maximum	Minimum	7 a. m.	3 p. m.	11 p. m	Mean.	Maximum	Miniman	Maximum	Minimum	7 F. E.	8 p. m.	11 p. m	Mean.	7 8.10.	3 p. E.	11 p. m	Kep.
J F M J J S O D	In. 27. 805 27. 221 27. 823 27. 179 27. 194 27. 256 27. 259 27. 279 27. 203 27. 278 27. 278	27. 63 27. 50 27. 55 27. 51 27. 45 27. 44 27. 38 27. 41 27. 46 27. 55 27. 55 27. 57	26. 67 26. 77 26. 79 26. 90 26. 90 27. 10 27. 04 26. 33 27. 02 26. 53 26. 57 26. 57	0 21. 7 26. 1 86. 4 47. 6 51. 9 68. 9 68. 9 68. 9 68. 9 42. 6 88. 3 88. 6	0 84. 9 41. 4 56. 0 65. 4 67. 6 80. 3 86. 9 84. 1 79. 6 67. 7 61. 9 49. 5	25. 1 29. 1 43. 4 54. 9 58. 4 71. 5 73. 8 65. 6 50. 2 43. 0 86. 2 52. 2	27. 2 82. 2 45. 8 56. 0 59. 8 72. 2 77. 6 67. 9 53. 5 47. 4 89. 8 54. 4	95 95 99 98 98 88	- 6 - 2 18 82 85 64 50 49 21 21 26 7	69. 9 69. 9 71. 8 83. 6 89. 1 62. 1 71. 4 63. 6	0 16.6 21.7 83.7 45.5 50.4 62.5 64.4 57.6 41.1 34.3 28.6 48.6	0 17, 5 20, 7 31, 3 41, 2 49, 4 61, 1 62, 4 58, 7 54, 7 28, 4 28, 4 28, 4	50. 4 62. 7 64. 0 59. 8 54. 2 26. 8 43. 8	42.4 51.1 64.5 64.4 50.0 54.4 80.0	69. 2	89 91 88 81 79 88	68 64 44 67 69 48 47 46 85 85 85 86	83 78 73 66 78 80 61 80 61 83 72	7772 66 64 775 76 66 61 66 775 68
		[Latite	nde, 31	o 47′ ]	N.; la	ngitu	<b>E</b> L 1 de, 1				oal ti	me, 2.	06 alo	w, Be	stern	.]			
J F M J J S O N T	26. 303 26. 208 26. 295 26. 188 26. 167 26. 239 26. 271 26. 274 26. 265 26. 289 26. 292 26. 335 26. 261	26. 61 26. 57 26. 53 26. 41 26. 35 26. 41 26. 43 26. 46 26. 47 26. 55 26. 67	26. 01 25. 93 26. 02 25. 94 25. 95 26. 01 26. 06 26. 03 26. 03 26. 03 25. 85 25. 83	82. 9 89. 2 46. 9 51. 7 58. 2 60. 8 70. 7 70. 5 62. 8 51. 2 43. 1 35. 7 52. 4	50. 8 60. 2 66. 4 74. 9 80. 5 90. 2 91. 8 89. 5 82. 9 74. 2 65. 0 57. 0 73. 6	41. 8 50. 8 56. 4 64. 2 70. 2 78. 0 80. 9 79. 0 72. 5 61. 4 53. 2 47. 4 62. 9	72.6 62.8 53.8 46.7	90 101 107 108 110	15 26 29 88 49 59 61 49 23 12 12	56. 6 66. 5 72. 0 81. 5 89. 8 99. 2 102. 0 97. 0 88. 7 77. 7 68. 0 60. 8 80. 0	29. 7 85. 9 44. 5 50. 2 57. 0 65. 0 70. 0 69. 1 60. 9 48. 3 89. 8 81. 6 50. 2	23. 3 22. 0 33. 0 30. 9 37. 6 48. 3 58. 2 55. 2 49. 1 36. 5 29. 5 23. 7 36. 9	21. 7 15. 0 26. 0 24. 5 30. 3 35. 4 54. 2 63. 0 46. 6 87. 6 20. 6 31. 8	25. 4 19. 0 81. 9 25. 8 86. 0 41. 8 56. 4 53. 5 47. 5 35. 8 29. 7 24. 6 85. 7	28. 5 19. 0 20. 3 27. 1 84. 6 40. 0 56. 3 54. 1 47. 7 36. 6 29. 4 23. 0 35. 1	69 58 61 47 52 47 60 61 63 59 61	25 19 26 19 21 19 29 20 26 27 26 27	844年484日本日本日本日本日本日本日本日本日本日本日本日本日本日本日本日本日本日本日	53 53 53 53 54 54 54 54 54 54 54 54 54 54 54 54 54
		[Lati	tude, 4	<b>2</b> 0 7′ ]	N.; lo	ngitu		RIE P &	•		al tim	e, 0. <b>3</b> 0	alow	, Eas	orn.]				_
J F M J A O N Y	29, 322 20, 232 29, 298 20, 801 20, 207 20, 249 29, 246 29, 244 29, 244 29, 244 29, 256 29, 256		28, 81 28, 89 29, 00 28, 72 28, 88 28, 74 28, 89 28, 38		26. 4 92. 9 26. 8 40. 8 58. 9 67. 5 74. 9 66. 1 54. 6 42. 6 83. 5 49. 4	25. 1 43. 5 55. 2 61. 4 68. 8 63. 2 60. 0 48. 5 40. 5	25. 0 44. 8 56. 1 63. 6 71. 0 65. 4 61. 4 50. 0 40. 7	57 48 58 84 81 85 90 86 81 76 71 65	- 4 -12 - 1 22 31 45 53 48 48 48 23 3 -12	30. 9 28. 0 83. 2 53. 2 64. 3 78. 3 79. 7 74. 1 70. 7 59. 5 40. 1 41. 5 54. 8	16.7 9.5 16.7 36.0 47.8 54.4 63.0 58.7 53.8 43.1 35.0 24.5 88.3	14. 4 9. 6 15. 8 33. 6 47. 0 60. 2 57. 1 49. 2 40. 2 34. 3 36. 4	17.5 85.1 46.8 85.3 68.4 59.0 51.1 42.7	12.6 18.7 85.8 47.9 64.3 61.6 57.1 50.4 41.7 83.4 25.4	16.9 18.1 17.8 84.6 47.1 54.5 61.4 57.7 50.2 41.5 83.2 25.2 87.7	77 78 78 80	72 75 66 66 66 67 61 66 72 74 66	181819191918191	74 77 78 70 73 73 73 77 68 74 76 78
		[Latit	tude, 4	50 48/	N.; 1		SCA:			MIC:		me, 0.4	18 alor	w, Ea	stern.	]			
J F M J J 8	29. 321 29. 256 29. 828 29. 337 20. 214 29. 288 20. 243 29. 284 20. 328 29. 313	29. 74 29. 68 29. 52 29. 62 29. 56 29. 65 29. 62	28. 71 28. 54 28. 79 28. 67 28. 90 28. 94 28. 81 28. 89 28. 88	30. 2 42. 8 54. 4 62. 6 58. 1 50. 5 87. 9	41. 2 53. 8 60. 4 73. 8 64. 8 60. 6 46. 5	18. 3 34. 1 46. 3 57. 4 66. 3 58. 0 54. 7 41. 8	35. 2 47. 6 59. 4 67. 6 59. 6 55. 3 42. 1	54 76 80 87 83 77 63	10 27 24 47 89 80 24	15. 1 15. 6 25. 3 43. 8 56. 4 69. 6 75. 7 67. 1 64. 8	26. 7 80. 4 40. 0 58. 6 52. 1 46. 8 85. 5	22.7 84.2 44.8 54.8 50.9 44.9 88.4	26. 8 87./2 48. 8 59. 0 52. 1 46. 9 85. 5	-9.1 6.4 26.0 87.1 47.4 58.6 52.2 47.7 35.9	25. 0 26. 2 47. 0 57. 5 51. 7 46. 5 84. 9	72 71 71 71 88 86 86	888988	は大はななない	71 00 00 00 00 71 77 74 76 00 00 00 00 00 00 00 00 00 00 00 00 00
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ELLIOTT, FORT, TEX. H=2,650. A=1.

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7 P. IB.	8 p. m.	11 p. m.		Mosn.	Total (miles).	Maximum.	Direction.	North.	Northeast.	East.	Southeast	South.	Southwest.	West.	Northwest.	Calma.	Total.	Max. 24 bours.	Clear.	Fair.	Cloudy.	Rain or snow.	Max. below 32°.	Min. below 32°.	Max. above 90c.	7 hunder-storms.	Auroras.	Months and year.
2.16 2.28 5.28 5.38 7.17 2.48 6	4.74 4.5 5.4.2 3.2 3.4.4.1	2232442311132	73 93 84 75 43 51 22 23 93	4 4 6 1 8 8 5 4 1 5 9 5	8, 14 6, 71 7, 48 9, 79 8, 69 8, 70 6, 60 7, 71 6, 58 8, 30 92, 21	1 40 6 48 1 44 6 51 6 36 8 40 8 43 9 45 1 51 7 64	8. 8E. W. NW. NW. NW.	10 22 13 11 16 7 1 19 12 13 6 8 128	2047661922649	0 1 1 7 4 1 8 8 0 3 8 27	10 9 11 18 16 33 16 12 11 7 5 9	18 25 26 89 17 13 21	10 4 8 8 6 7 17 14 11 13 14 12 124	5 12 7 2 8 0 4 4 2 2 6 4 51	30 15 22 14 14 8 9 6 26 23 31 201	8 10 8 8 7 5 8 7 4 8 8 1 77	In. 0. 45 0. 87 1. 86 4. 67 7. 28 9. 82 4. 94 0. 65 0. 25 2. 11 37. 07	In. 0. 87 0. 72 1. 08 2. 87 3. 32 2. 30 3. 47 1. 44 0. 42 0. 25 0. 61 3. 47	19 15 14 9 8 14 15 16 20 16 14	7 10 14 18 15 16 12 13 8 11 10 150	5 3 8 7 6 1 4 1 1 1 7	3 4 6 9 10 13 3 9 3 2 2 8 72	0000004	28 22 13 0 0 0 0 0 2 8 19 92	0 0 0 0 4 14 9 0 0 0 0 27	4 5 1 0	00000000000	M J J A S O N D
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242347123	5.1 5.3 6.1 5.3 4.1 6.1 7.3 7.3 7.4 1.0	23.4.4.1.0.3.2	93 33 74 23 54 72 71 02 53	6 0 1 2 8 1	3, 29 3, 62 3, 77 3, 94 3, 86 3, 50 2, 95 3, 39 2, 61 2, 85 3, 09 2, 70 30, 50	2 29 8 29 9 30 11 20 3 26 52 28 66 29 12 19 59 29 18 23	SW.	3 1 5 1 4 5 4 5 4 8 7 3 48	14 5 15 10 10 13 20 9 10 7 4 7	17 4 7 5 11 6 28 42 27 29 10 14 200	1 3 9 2 5 4 5 1 11 20 6 3 70	0	11 13 2 2 3 2 2 2	35 42 28 35 35 36 16 17 4 16 13 292	5 4 8 13 4 9 10 16 35 40	10 8 5 10 12	0, 03 0, 34 0, 04 1, 27 2, 63 1, 06 0, 46 0, 22 0, 46 0, 31 0, 37	0. 06 0. 02 0. 15 0. 03 0. 69 1. 43 0. 47 0. 22 0. 11 0. 46 0. 20 0. 26 1. 43	17 8 12 14 10 11 14 22 26 16 15	13 17 19 12 6 4 12 12	1 2	4 3 6 3 7 9 9 8 5 1 1 3 2 6 6 6	000000	18 7 2 0 0 0 0 0 0 0 0 5 11 43	0 0 0 0 16 29 31 27 11 0 0	5 10 6 7 1 0 0	000000000000000000000000000000000000000	MAMJJASOND
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FORT SMITH, ARK.
[Latitude, 35° 22' N.; longitude, 94° 24' W. Local time, 1.17 slow, Eastern.;

	Pr	<b>088</b> 1176	•			Ten	perat	are				1	Dew 1	oint.		1	Role	tive dit	<b>;</b> .
Months and year.	Mean.	Maximum.	Minimam.	7 a. m.	8 p. m.	11 р. ш.	Moan.	Maximum.	Minimum.	Maxtenm.	Kinimam.	7 a. m.	8 p. m.	11 p.m.	Moan.	7 a. m.	8 p. m.	11 p. m.	Moen.
J F M J S O D	In. 29. 693 29. 572 29. 642 29. 483 29. 451 29. 506 29. 486 29. 507 29. 527 29. 527 29. 543 29. 544	29. 88 29. 75 29. 70	In. 28. 93 29. 11 29. 14 29. 09 29. 26 29. 27 29. 20 28. 82 28. 82	26. 8 28. 1 39. 4 54. 4 58. 1 70. 1 78. 5 69. 7 63. 6 42. 4 84. 4 50. 7	48.6 55.8 69.2 74.8 82.5 88.8 86.4	0 81. 7 85. 6 48. 8 61. 7 64. 8 74. 0 78. 1 75. 5 69. 1 55. 1 50. 2 40. 2 57. 0	47. 8 61. 8 65. 6 75. 5 80. 0	99 74 80 84 86 93 97 91 88 80 75	0 24 40 41 61 64 57 49 82 25 10	59. 9 73. 6 76. 5	0 24. 1 25. 0 87. 1 52. 2 56. 6 67. 9 71. 5 68. 8 40. 8 40. 8 31. 5 48. 6	28. 8 28. 1 84. 6 50. 1 56. 8 71. 5 66. 8 69. 3 44. 6 87. 0 27. 8 46. 9	90. 4 29. 0 37. 2 54. 9 59. 7 71. 2 74. 6 69. 6 61. 5 46. 2 37. 1 30. 8 50. 1	27. 9 28. 2 28. 3 53. 8 59. 6 70. 6 63. 4 48. 8 89. 1 31. 8 50. 6	52. 9 56. 8 69. 9	82 84 86 91 93 94 91 89 87 82 79	74 69 52 61 70 65 59 49 45 49 58	85 75 71 76 85 99 91 85 82 80 67 72 80	88 78 75 75 65

#### FRISCO, UTAH.

#### [Latitude, 39° 25' N.; longitude, 113° 16' W. Lecal time, 2.33 alow, Eastern.]

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8	28. 742	23. 92	23. 47	57. 3	70. 2	68. 8	68.6	81	36	78.8	55. 2	80.1	28.8	28. 3	29. 1	37	22	29	20
Q	23.778		23. 56	48.6	61. 4	52.7	54.2	77	27			25. 2	23. 1 25. 8	24.6		43	26	37	28 25
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#### GALVESTON, TEX.

#### [Latitude, 29° 19' N.; longitude, 94° 47' W. Local time, 1.19 slow, Eastern.]

#### GRAND HAVEN, MICH.

#### [Latitude, 43° 5' N.; longitude, 86° 18' W. Local time, 0.45 slow, Eastern.]

FORT SMITH, ARK.

[ <i>H</i> ⇒470.	A=48.]

		( <i>H</i> =	470. A=48.]			
Cloudiness (in tenths).		Wind.		Precipi- tation.	Number of days	
7 a. m. 8 p. m. 11 p. m. Mean.	Total (miles). Maximum. Direction.	Northeast.  Rast. Southeast. Southeast.	Southwest. West. Northwest. Calms.	Total. Max. 24 hours.	Fair. Cloudy. Rain or snow. Max. below 820. Min. below 820.	Thunder-storms. Auroras. Months and year.
2 65. 54. 44. 5 4. 74. 52. 84. 85 5. 74. 44. 24. 8 5. 83. 54. 25. 0 5. 84. 64. 25. 4 2. 63. 4°2. 24. 0 4. 95. 23. 14. 4 5. 56. 38. 55. 1 2. 84. 42. 94. 0 4. 14. 6°3. 44. 0 5. 56. 0°2. 54. 7 4. 85. 82. 94. 7	4, 707 30 W. 4, 294 23 NW. 4, 419 24 NW. 4, 479 25 E. 2, 798 22 NW. N 2, 798 17 SW. 2, 563 26 N. 3, 606 18 N. 3, 217 17 SW. 4, 418 32 N. 4, 418 32 N.	11 18 20 8 3 8 18 18 19 9 11 2 8 26 1 10 5 9 27 8 8 7 42 7 6 11 6 5 6 4 6 5 6 4 6 5 6 4 6 5 6 0 71 71	15 7 2 23 9 9 1 21 2 2 4 12 8 4 12 16 8 9 9 18 3 8 14 8	1. 691. 66 1. 680. 64 1. 680. 64 1. 680. 68 1. 680. 683 4. 881. 05 2. 480. 75 1. 290. 1. 25 0. 990. 48 12. 311. 71 1. 120. 47	13 11 7 9 4 21 0 9 12 10 9 8 0 9 0 10 11 9 13 0 0 0 0 8 11 9 11 0 0 0 0 8 11 11 11 13 0 0 6 6 11 11 18 5 0 0 11 11 18 5 0 0 11 11 18 5 0 0 11 11 11 8 5 0 0 11 11 11 8 7 8 1 17 0 13 11 18 7 8 1 17 0 13 11 18 7 8 1 17 0 11 13 91 89 7 75 45	1 0 M. 5 0 A. 4 0 M. 8 0 J. 7 0 J. 5 0 A. 6 0 S. 1 0 O. 8 0 N.
		FRIS	CO, UTAH.			
1.72.70.71.7	9, 676,57 SW. 7, 172,35 SW. 7, 978,42 SW. 5, 777,36 SW. 8, 072,42 SW. 6, 046,40 NW.	5 4 0 1 10 15 4 2 3 12 19 8 1 0 7 28 6 8 2 5 14 4 0 1 10 18 3 1 5 4	59 4 10 0 85 12 10 0 41 7 7 0 31 8 7 0	0. 150. 121 8. 96 2. 80 1 0. 07 0. 07 2 0. 460. 87 2 0. 97 0. 0. 60 1	8 12 1 2 0 0 2 0 18 8 8 0 0 1 0 0 0 0 5 6 0 8 0 2 0 1 1 18 7 6 3 21 0	J J M J M J J J J J J. 11 0 A. 0 0 S. 11 0 O. 0 0 D Y.
		GALV.	ESTON, TEX 40. A = 51.]	ζ.	<del></del>	
4, 75, 64, 34, 8 6, 56, 24, 05, 5 5, 25, 75, 05, 3 6, 04, 76, 05, 3 3, 84, 32, 03, 3 3, 64, 72, 23, 5 3, 94, 72, 33, 7 5, 25, 53, 84, 2	0, 025 37 N. 8, 672 26 N. 7, 518 32 N. 8, 555 32 SE. 7, 787 37 NE. 5, 739 34 NE. 6, 699 34 NE. 8, 025 24 NE. 8, 028 35 N. 7, 772 32 N. 7, 363 34 N. 8, 517 35 N., SE.	18 13 21 9 12 21 11 13 8 16 11 14 16 25 13 11 4 11 29 30 16 10 9 27 18 0 1 1 23 50 5 1 1 4 30 6 9 8 19 33 12 19 14 10 30 14 11 14 16 19 21 6 10 12 27 17 5 16 21 19 152 104 134 203 332	6 4 4 1 1 5 1 8 0 0 0 9 7 4 1 1 1 1 0 15 8 3 0 0 0 12 3 3 0 0 0 0 19 0 0 0 19 0 0 0 14 2 3 4 1 1 4 2 8 1	2. 04 0. 93 1 3. 17 1. 22 4. 12 2. 68 6. 41 3. 35 5. 28 2. 52 1 2. 20 0. 91 1 1. 74 0. 80 1 26. 01 7. 09 1 2. 32 1. 93 1	8 12 11 12 0 4 0 12 6 10 7 0 2 0 0 0 7 14 9 6 0 0 0 0 0 0 15 15 0 5 0 0 4 12 3 7 0 0 7 11 11 8 13 0 0 1 11 11 8 13 0 0 1 0 1 12 2 5 0 0 0 0 15 7 68 92 0 6 31	1 0 J. 1 0 F. 1 0 M. 2 0 A. 4 0 M. 8 0 J. 8 0 J. 7 0 A. 6 0 S. 0 0 O. 1 0 N. 35 0 Y.
		GRAND I	HAVEN, MI 120. A=74.}	CH.		
2. 60. 38. 78. 91 7. 87. 25. 97. 0 8. 56. 76. 25. 8 8. 78. 65. 75. 7 5. 44. 02. 84. 1 4. 22. 43. 42. 7 5. 84. 25. 34. 8 5. 94. 25. 34. 8 5. 94. 25. 34. 8 9. 98. 68. 78. 8 8. 98. 07. 78. 21	1, 002 27 NW. 7, 054 35 SW. 7, 958 49 NW. 9, 101 35 W. 6, 400 11 N. 6, 127 93 S. 6, 127 93 S. 6, 127 93 S. 7, 967 34 W. 8, 538 36 W. 1, 967 34 W.	5 8 6 6 15 9 8 8 9 11 11 8 4 5 11 9 14 13 7 13 5 9 11 1 22 4 5 6 2 23 6 4 7 7 20 11 6 12 9 12 5 2 17 12 17 8 20 14 15 10 10 8 13 7 8 7 12 10 11 16 90 104 121 91 179	16 12 10 1 17 11 15 17 1 9 8 17 18 14 8 16 8 16 14 14 6 9 17 14 6 6 9 17 11 11 12 7 7 7 8 9 2 9 15 18 9 17	1. 57 0. 44 1. 02 0. 24 1. 38 0. 56 1. 17 0. 45 5. 64 1. 68 8. 18 2. 02 4. 82 1. 22 4. 71 2. 77 4. 15 2. 27 1. 63 0. 84 8. 38 0. 89	1 6 24 25 20 28 0 8 9 16 14 20 28 0 5 16 10 13 12 29 0 10 16 4 8 0 0 0 12 16 2 9 0 0 0 10 16 5 11 0 0 10 16 5 11 0 0 18 15 8 16 0 0 0 11 10 9 9 0 0 0 17 7 17 17 0 2 0 0 7 23 16 0 10 0 10 14 148 171 66 130 0	0 0 J. 0 0 F. 0 0 M. 1 0 A. 0 1 M. 7 0 J. 6 0 J. 7 0 A. 0 1 S. 0 0 N. 0 0 D.

#### GRANT, FORT, ARIZ.

[Latitude, 82° 89' N.; longitude, 109° 57' W. Local time, 2.20 slow, Eastern.]

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and year.		•	•							Mo									
Months a	Mosn.	Maximum.	Kinimam.	7 a. m.	8 p. m.	11 p. m.	Mean.	Maximum.	Minimum	Maximum	Minimum.	7 a. m.	8 р. ш.	11 p. m.	Mosn.	7 a. m.	8 p. m.	11 p. m.	Mean.
J F M J J S ON Y	##. 25. 240 25. 188 25. 251 25. 168 25. 148 25. 235 25. 271 26. 266 25. 238 25. 274 26. 274 26. 280	In. 25. 46 25. 45 25. 43 25. 43 25. 23 25. 88 25. 87 25. 84 26. 34 26. 35 25. 53 25. 53	25. 09 25. 08 24. 98 25. 07 25. 17 25. 20 25. 12 25. 09 24. 87 24. 89	o 83. 1 86. 3 44. 7 48. 8 55. 2 62. 5 68. 9 63. 4 55. 1 46. 5 89. 6 51. 8	0 49. 5 54. 5 60. 9 66. 2 74. 7 79. 8 85. 2 83. 4 81. 1 74. 9 61. 7 56. 8 69. 0	46. 6 58. 6 58. 3 66. 7 72. 4 79. 0	45. 8 53. 1 57. 8 65. 5 71. 6 77. 7 75. 4 72. 4 65. 1 54. 1 47. 8	73 77 82 94 92 100 96 91 86 76	87 86 48 49 62 60 56 45 84 22	o 53. 2 60. 1 60. 4 72. 6 80. 4 85. 8 91. 2 87. 0 84. 2 77. 6 64. 8 59. 3	48. 2 54. 9 62. 0 68. 2 66. 8 62. 7 54. 6 45. 7 88. 7	o 28. 8 25. 3 84. 4 84. 3 82. 8 86. 8 42. 4 46. 1 37. 9 29. 0 80. 2 24. 2 83. 1	23. 8 84. 5 80. 2 85. 3	84. 7 82. 8 84. 9 89. 8 51. 4 54. 0 44. 7 85. 9	84. 5 82. 8 84. 8 88. 8 48. 4 50. 8 42. 3 84. 5 83. 9 27. 6	68 58 44 89 40 50 41	40 27 26 27 33 36 29 28 42 39	58 48 51 88 83 83 41 50 40 85 50 51 43	41 34 33 88 45 37 34 49

#### GREENCASTLE, IND.

[Latitude, 39° 39' N.; longitude, 86° 51' W. Local time, 0.47 alow, Eastern.]

#### HATTERAS, N.C.

[Latitude, 85° 15' N.; longitude, 75° 40' W. Local time, 0.02 alow, Eastern.]

#### HELENA, MONT.

[Latitude, 46° 33' N.; longitude, 112° 4' W. Local time, 2. 28 slow, Eastern.]

GRANT, FORT, ARIZ. [H=4,856. h=1.]

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	oue 1 te							V	Vin	d.							Prec tati			Nu	mì	ær	of	day	8—	•	1	
7 a. m.	8 p. H.	1 a 1		Mean.	Total (miles).	Maximum.	Direction.	North.	Northeast.	East.	Southeast.	South.	Southwest.	West.	Northwest.	Calms.	Total.	Max. 24 hours.	Clear.	Fair.	Cloudy.	Rain or snow.	Max. below 82°.	Min. below 82°.	Мах. авоте 90.0	Thunder-storms.	Auroras.	Months and year.
25 1.4 4.2 1.2 0.8 2.0 2.2 2.6 1.0 2.7 1.7 1.9	2.4 4.0 3.0 3.0 3.7 4.2 0.2 2.0 2.0	2531022	2 2 2 2 1 3 8 3 9 1 5 0 2 2 0 2	4 7 6 7 6 7	4, 723 4, 748 4, 951 5, 268 5, 245 5, 0647 4, 995 4, 974 5, 367 4, 759 5, 727 60, 440	43 82 84 28 42 35 36 30 37 31 29 40	SE. W. SE. W., SE. SE., S. SE., SE. SE., SE.	15 17 14 27 20 12 10 16 24 27 27 19 228	14 8 11 8 8 6 11 11 19 6 7	3 2 2 2 0	17 10 19 8 7 10 9 25 24 16 19 18 182	15 8 13 4 12 13 15 19 8 11 4 8 130	5 7 8 10 11 13 7 3 8 2 7 6 82	5 18 15 15 12 21 18 9 9 15 12 158	9 13 16 20 11 25 6 6 11 18 150	000001201004	1. 02 1. 40 0. 04 0. 25 0. 73 0. 93 1. 58 0. 81 0. 03 1. 30 0. 81	In. 0. 22 0. 74 0. 61 0. 04 0. 36 0. 64 0. 02 0. 58 0. 74 0. 74	21 23 14 20 23 19 13 14 23 80 19 21 240	9 2 11 9 7 14 15 7 8 99	1 3 6 1 1 2 4 2 0 0 4 2 2 6	4 3 7 1 3 8 11 11 7 2 5 6 6	0000000	0	20	13 6	000000000	J. F. M. A. J. J. A. S. O. N. D. Y.
GREENCASTLE, IND. [H=897. h=69.]														_														
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77.05.35.3	5, 057 40	W.	2	16	5	. 9	19	31	3	1 7	7.	56 3. 0	8 8	17	6			0 17 9	0 1
88.15.26.4	3, 835 30	SE.	3	25		10	9	10		1 6	19.	63 6, 2	) 5	13	12				0 8
1 5. 64. 04. 6	5, 598 36	S.	10	20	4	9	-6	14			3.	36 2. 9	11	14	- 6	7	0	0 0 0	0 0
2 8 4 7 3 0 3 8	3, 669 24		3		2	9 7 3	9	10				50 0. 11					0		0 N
44.71.04.0	4, 683 33	W.	3			- 3	7					76 4. 4				7	0	0 0 2	O T
4.86.14.25.0	56, 339	Lb. Carlo	53	200	53	124	131					00 6, 20				145	0	1 54 57	0 3

## KEOKUK, IOWA.

		[L	titude	, 400	22′; 1	ongit	nde, 9	10 2	ø. :	Local	time,	1.06 a	low, I	Casto	n.]				
	Pr	essure	.			Te	mper	atur	ю.			1	Dow I	oint.			Rela		
d year.		•						١		Med							1		
Months and year	Mesn.	Maximum	Minimum	7 e. m.	8 p. m.	11 р. ш.	Mean.	Maximum	Minimam	Maximum	Minimum	7 a. m.	8 p. m.	11 р. m.	Mean	7 e. m.	8 p. E.	11 p.m.	Mean.
J M M J 80 ND	In. 29, 499 29, 375 29, 430 29, 316 29, 267 29, 359 29, 314 29, 326 29, 316 29, 413 29, 357	29. 55	29, 08 28, 85 28, 92 28, 73 28, 67	10. 6 28. 8 44. 7 54. 1 65. 4 72. 8	22. 4 40. 8 55. 1 68. 2 76. 7 86. 4 71. 6 57. 2 46. 2 33. 5	16. 4 54. 6 49. 4 59. 5 68. 1 76. 8 68. 9 63. 7 48. 2 40. 3 28. 4	16. 5 84. 7 49. 7 60. 6 70. 1 78. 5 70. 0 64. 6 49. 4 40. 6 28. 7	46 60 77 84 89 98 84 77 73 55	0 -14 -14 9 28 82 49 58 49 46 80 22 - 5 -14	24. 7 25. 9 48. 5 58. 6 70. 8 79. 0 87. 9 81. 4 78. 7 59. 7 50. 7 86. 7	7. 5 7. 8 26. 9 41. 9 50. 9 61. 5 69. 3 61. 4 1: 0 82. 6 19. 9 89. 8	59. 8 67. 1 59. 9 54. 4 89. 1 80. 7 20. 2	43. 2 50. 7 61. 6 68. 5 60. 7 55. 8 42. 5 84. 6 24. 8	50. 6 62. 4 69. 5 61. 6 56. 7 40. 2 83. 0	10.9 25.4 41.8 49.6 61.8 68.4	81 80 85 79 82 83 87 86 87 84 84	71 73 57 64 55 61 56 59 61 65 72 63	90 82 73 79 73 82 78 78 79 75 77	74 76 80
		Latit	ıde, 36	o 85/ ]	N.; lo	ngita	KER				ocal t	ime, 2.	51 alo	w, Es	stern	]			_
J F M J J S O N	26. 376 26. 213 26. 188 26. 219 26. 266 26. 272 26. 255 26. 335 20. 296 26. 417	26. 72 26. 53 26. 37 26. 44 26. 45 26. 44 26. 53 26. 62 26. 73	26. 16 25. 89 25. 96 25. 99 26. 09 26. 00 26 14 25. 85 26. 06	44. 7 48. 4 57. 3 59. 6 68. 6 72. 0 66. 3 57. 2 46. 9 41. 0	62. 8 66. 2 77. 0 79. 3 90. 0 87. 5 79. 1 69. 1 56. 1 49. 6	55. 8 58. 8 69. 8 71. 2 81. 8 83. 4 77. 0 66. 8 52. 1 45. 6	54. 8 57. 8 68. 0 69. 7 80. 1 81. 0 74. 1 64. 4 51. 7	78 96 94 105	84 87 42 46 61 62 50 47 86 81	66. 7 70. 1 80. 2 83. 0 93. 8 93. 5 87. 1 77. 0 61. 0 54. 3	48. 0 46. 8 55. 6 57. 2 66. 7 68. 9 62. 1 58. 9 43. 2 87. 5	88. 8 85. 7 41. 4 89. 1 49. 4 51. 6 89. 0 86. 2 85. 1 80. 2	41. 0 48. 8 49. 8 46. 0 58. 5 56. 4 45. 1 40. 9 86. 9	87. 4 89. 5 44. 8 41. 6 53. 0 51. 2 89. 8 86. 4 83. 5	87. 2 89. 5 45. 2 42. 2 53. 6 58. 1 41. 8 87. 8 85. 2 81. 4	64 56 49 51 51 88 47 65	47 47 89 82 85 87 81 88 50	52 52 41 36 38 35 28 35 52 57	55 54 45 39 41 41 32 40 56
!										FLA								!	
	90 117		nde, 2			<del></del>	·					me, 0.5				_	70	ارم	
J M J S D Y	80.117 80.035 80.097 80.029 99.961 80.051 80.068 80.007 29.962 29.943 80.027 80.120 80.035	30. 28 30. 27 30. 33 30. 18 30. 16 30. 19 30. 12 30. 09 80. 11 30. 21 30. 35	29. 92 29. 81 29. 91 29. 92 29. 82 29. 96 29. 96 29. 70 29. 88 29. 70 29. 70	69. 8 66. 5 68. 6 74. 8 79. 4 82. 0 83. 9 82. 2 76. 6 69. 6 63. 3 75. 0	70.7 74.7	70. 8 67. 4 69. 2 73. 8 77. 6 79. 9 82. 8 82. 7 81. 9 76. 5 71. 0 64. 0 74. 8	71. 9 68. 2 76. 0 80. 4 82. 6 84. 9 85. 1 84. 0 77. 8 76. 1 64. 7	85 86 91	59 56 61 67 70 72 73 75 79 56 50	76. 9 73. 2 76. 4 81. 8 86. 3 88. 4 91. 4 91. 3 89. 8 82. 0 76. 1 69. 2 81. 9	68. 2 63. 8 65. 7 71. 9 75. 6 77. 6 79. 7 79. 0 74. 4 68. 1 61. 1 72. 1	66. 0 61. 0 63. 1 66. 9 72. 8 74. 7 76. 6 77. 4 69. 8 64. 5 58. 4	67. 0 61. 8 68. 7 67. 4 71. 9 74. 4 75. 1 76. 7 78. 4 64. 9 59. 8 69. 2	66. 4 61. 0 63. 9 66. 8 71. 9 78. 8 74. 7 76. 2 77. 0 69. 3 65. 0 68. 8	66. 5 63. 6 67. 0 74. 2 74. 8 76. 5 77. 6 60. 8 54. 8 58. 9 68. 9	79 74 79 86 80 84	76 74 69 67 67 69 66 68 74 73 78 71	87 81 84 79 83 82 78 81 85 79 82 84 82	84 79 74 76 77 72 76 82 77 82 77
		[Lat	itude,	86° 19	.; lor					K, N. Leo		e, 0.03	alow,	East	ern.]				
J M M J S O D	30, 170 29, 995 30, 070 30, 065 29, 947 30, 056 30, 007 29, 996 30, 074 80, 005 30, 007 30, 008	30. 74 20. 50 80. 54 80. 56 30. 21 30. 30 80. 24 30. 23 30. 34 30. 34 30. 39 30. 72	29. 63 29. 28 29. 57 29. 56 29. 50 29. 72 29. 64 28. 44 29. 30 29. 60 29. 40 29. 28	43.5 36.9 38.2 51.4 61.7 70.5 77.2 75.7 68.8 60.8 48.5 42.9 56.8	47. 2 44. 1 45. 6 58. 8 76. 8 87. 0 81. 8 74. 3 65. 9 55. 8 48. 7 62. 4		45 4 89. 0 41. 7 54. 8 63. 6 72. 4 80. 3 77. 8 70. 7 62. 6 52. 0 45. 4 58. 7	72 64 68 90 87 96 98 95 91 84 75 68 98	22 15 22 85 46 56 60 63 52 45 86 25	53. 4 46. 2 49. 9 62. 7 71. 1 81. 1 89. 7 84. 6 76. 2 67. 8 59. 1 53. 1 66. 2	87. 4 81. 2 85. 1 46. 8 57. 5 66. 6 73. 0 65. 7 57. 4 45. 7 87. 8 52. 2	38. 8 31. 3 88. 1 40. 6 58. 6 65. 7 71. 5 70. 9 64. 4 55. 8 43. 2 86. 2 51. 3	80.7	88. 9 82. 8 85. 8 48. 4 50. 3 65. 4 71. 8 65. 0 55. 7 44. 1 85. 0	88. 8 81. 4 84. 5 47. 9 50. 7 65. 9 71. 8 64. 6 55. 8 48. 5 85. 0 51. 7		74 68 68 72 83 73 68 72 72 73 65 62 70	79 77 80 84 90 85 87 87 87 87 88 76 71	79 75 77 88 88 81 72 82 70 70

#### Monthly and yearly meteorological summaries—Continued.

KROKUK, IOWA.

											ī	H=	= 61	8.	h=	60.	)												_
Ci Ci	lou a t	ıd:	he	30 3).						Wi	nd.						1	Prec	ipi- on.		Nu	mb	er	of	day	<b>18</b>	-	١	
7 b. m.	8 D. III.		Пр. ш.	Mean.	Total (miles).		Maximum.	Direction.	North.	Northeast.	East.	Southeast.	South.	Southwest.	West.	Northwest.	Calms.	Total.	Max. 24 hours.	Clear.	Fair.	Cloudy.	Rain or snow.	Max. below 32°.	Min. below 82º.	Max. above 80°.	Thunder-storms.	Auroras.	Months and year.
3.4 6.3 3.9 4.8 3.7	447.555.544	4 2 3 3 1 6 3 4 0 4 5 4	1616 1617 1618 1618	4.4	7, 8 6, 2 5, 2 4, 8 5, 1 5, 1 6, 1 6, 4	94 59 08 01 00 32 80 53 54 95	27 28 31 28 36 26 20 27 23 28	SW. NW. NW. SE. W. SW. S. S. NW. SW. NW.	4 14 14 13 6 13 7 17 8 20 7 7	7 11 5 4 4 11 5 7	12 12 9 13 9 6 13	16 12 13 8 11 8 10 6	26 16 22 14 12 15	22 10 18 10 9	7	8 6 11 7 16 21 22	0 4 5 8 8 8 5 5	1. 14 0. 17 8. 33 2. 59 6. 97 2. 29 5. 98 8. 77 8. 59 0. 88	0. 09 0. 83 1. 05 2. 17 0. 82 2. 48 1. 57 1. 78 0. 77 0. 84	10 5 13 10 13 15 13	11 18 14 17 22 14 17 8 7	12 4 8 4 9 10 6	18 18 14 7 8 11 10	000000000000000000000000000000000000000	22 3 0 0 0 0 0 0 13 25	0 0 0 11 3 0 0 0	0 0 3 4 8 6 4 3 2 0	0100000100	J. F. M. A. M. J. J. A. S. O. N. D. Y.
_	<u></u>	_1_		<u> </u>	!. <u>.</u>	!			<u>!</u>	!	<u> </u>	KE H=			, C.			<u> </u>	1	l	<u> </u>	<u> </u>	<u> </u>	<u> </u>	1	<u> </u>	<u> </u>		
2.5 2.2 1.3 0.4 1.0 0.6 1.7 0.8	3. 2. 0. 1. 2. 0. 1. 3.	95960564	2.6 1.3 1.1 1.5 1.5 1.1 1.1	3, 2 2, 9 1, 7 0, 7 1, 1 1, 5 0, 4 1, 1 2, 4	4,1 5,3 4,1 4,4 3,2 3,8 3,1 4,4 2,6 38,8	378 121 113 222 341 580 128 122 500	38 32 45 24 27 42 24 31 40	NW. NW. SW. S. S. S. S. SE. S. NW.	17 8 3 4 10 6 6 11 14 14 14	13 13 13 14 14 20 3	3 5 12 10 11 20 28 14 9	11 11 9 16 15 16 7 2 7	16 14 8 9 9 4 1 6 13	29 22 15 13 15 17 25 25 13	4 6 11 10 3 7 5 1 7	13 8 9 12 0 3 2 2 1	5 3 13 15 21 9 2 6	0. 82 0. 00 0. 00 0. 00 0. 11 0. 00 0. 25 0. 63 0. 36	0. 08 0. 08 0. 08 0. 08 0. 00 0. 11 0. 00 0. 25 0. 42 0. 42 0. 42 0. 42	16 24 28 28 21 21 21 21 21 21 21 21 21 21 21 21 21	14 5			3 6 6 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0		0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	1 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	00000	D.

# 6 14 28 11 20 20 14 3 14 14 15 9 93 104 132 KEY WEST, FLA. [H=20. h=42.]

1 1 1 1	The second second		10	100	100					10	100								-1	
5, 1 5, 1 4, 4 4, 9	8,641 44	N.	12	29	12	21	9	5	1	3	0	4. 09 1. 88	7	15	8	12	0	0 0	1	0 J.
6. 1 3. 2 2. 4 4. 6	8, 708 36	NW.	20	19	13	10	8	11	1	2	0	4. 07 1. 67	10	13	5	15	0	0 0	1	0 F.
3, 8 4, 2 2, 1 3, 4	7, 875 31	NW.	18	21	17	10	8	4	1	12	2	1, 19 0, 41	14	16	1	7	0	0 0	1	0 M.
4.35.42.84.2	7 511 32	NE.	13	23	30	6	3	4	3	8	0	0. 47 0. 44	10	17	3	4	0			0 A.
5, 5, 6, 0 5, 1 5, 5	6, 645 30	NE.	11	12	17	6 22	13	5	2	11	0			17		12		0 2	1	0 M.
5, 7 6, 2 3, 4 5, 1	5, 622 24	S.	2 3	4	28	29	18	1	2	6	0	3. 58 1. 35	5	20	5	8	0	0 12	1	0 J.
5, 6, 6, 1, 3, 5, 5, 1	5, 103 24	SE.	3	11	26	15	7	16	1	2	2	3, 15 0, 85	2	26	3	13	0	0 28	4	0 J.
5, 8 5, 9 4, 5 5, 3	4, 823 24		3		31	25	8	7 5	1 5	3	2		3	25	3	12	0	0 23		
5, 9 5, 8 5, 0 5, 6	4, 544 33		3		27	23	6	- 5	7	9	3					14	0	0 16		
5, 8 6, 2 3, 8 5, 3	7, 428 29	NW.	12	34	12	3	3	11	8	8	2	5. 07 2. 60		20		11		0 0		
5, 7 5, 3 3, 5 4, 8	7, 358 28		20				8 6 3 2 6	1	5	12	3	0. 43 0. 37		17				0 0		0 N.
8, 0 5, 0 3, 9 5, 0	10, 938 42	N.	26	36	5	9	6	1	1	9	0	1. 72 1. 17		11				0 0	1	0 D.
5. 4 5. 5 3. 7 4. 9	85, 196		143	237	245	175	91	71	33	85	14	34. 03 2. 60	85	215	64	119	0	0 81 3	22	0 Y.
2.450.10.10.10.1				0.4	1.0	-	10		4.1		100	1000						- 1-1		1

#### KITTY HAWK, N. C. [H=9, h=2.]

		1 1	- 1		11.0			- 1				- 1		- 1	91		- 1	
6, 5 6, 9 5, 5 6, 3 12, 508 44	SW. 1	17	1	4	6 24		12	2	5, 45	1.26	3	16 12	18	0	10 0	0	0	J.
6 0 5 2 4 7 5 3 11, 135 56	N. 2		3	3	3 13	9	16	2	6. 17	2, 17	10				13 0	0	0	F.
4. 2 5, 5 6, 0 5, 2 12, 843 52	NE. 1	23	3 5	3 5	7 14	11	9	1	3.48	2, 17	9	12 10	15	2	9 0	0	0	M.
4, 1 4, 8 3, 4 4, 1 10, 126 44	N. 1	19		11	9 13	9	3	3	3, 95	1.28	15	8 7	12	0	0 0	0	0	Α.
6. 8 6. 1 4. 7 5. 9 8, 667 46	N. 1		14		12 14	10	1	0	6.76	1.37	5	15 11	16	0	0 0	2	0	M.
5, 3 5, 4 3, 5 4, 7 8, 947 37	NW.		13	8	9 18	10	3	1	3.81	0,88	8	13 9	10	0	0.7	3	0	J.
3. 4 3. 7 2. 0 3. 0 8, 147 28		7	11		15 28			1	0.94	0.56	16	15 0	6	0	0 16	2	0	J.
3.84.53.33.9 9,537 59					15 19							12 4						A.
5, 2 3, 9 2, 9 4, 0 8, 947 56			12	8	4 12	2						15 5				0	0	S.
3, 9 5, 1 3, 3 4, 1 10, 741 76	SE. 1				11 7	3	9	7	5, 03	1.60	11	15 5	9	0	0 0	0	-0	O.
5. 7 5. 0 5. 1 5. 3 9, 051 47	N. 1		3		11 19				4.55			19 4				1		N.
5, 3 5, 2 4, 1 4, 9 12, 851 65	NE. 1		0	2	9 18	20	10	5	6. 59	1.90	10	13 8	11	0				D.
5. 0 5. 1 4. 0 4. 7 123, 500	16	207	95	78 1	11 199	121	89	34 5	4.78	3. 61	119	162 84	136	3	37 33	9	0	Y.
		1 1					100											

#### KNOXVILLE, TENN.

[Latitude, 85° 50' N.; longitude, 83° 50' W. Lecal time, 0.36 slow, Eastern,]

		[Latit	ude, 8	50 56/	N.; l	ongit	ude, 8	3º 6	8 W	. L	cel ti	me, 0.	B6 alo	w, Es	stern	.]			_
	Pr	ognure.	•			Te	mper	stur	ю.			1	Dow 1	oint.		P	leks Lend	ناب رنگ	
I year.										Me	en.								
Months and year.	Mean.	Maximum.	Minimum.	7 p. m.	8 p. m.	11 p. m.	Mean.	Maximum.	Minimum.	Maximum.	Misimum.	7 to 10.	8 p. m.	11 р. m.	Mean.	78.10.	8 p. m.	11 p. m.	Meen.
J M A J S O D Y	7n. 29, 149 28, 904 29, 085 29, 080 28, 960 29, 063 29, 000 29, 063 20, 001 28, 019 28, 122 28, 039	In. 29. 57 29. 40 29. 42 29. 21 29. 24 29. 23 20. 17 29. 26 29. 22 29. 55 29. 57	28. 54 28. 58 28. 71 28. 53 28. 73 28. 82 28. 73 28. 79 28. 47 28. 42 28. 48 28. 48	0 30, 3 27, 8 36, 3 49, 3 57, 0 68, 4 69, 0 62, 1 40, 7 38, 6 49, 2	82. 6 85. 6 82. 9 77. 7 62. 7 53. 7 46. 8	34. 2 41. 6 56. 8 61. 7 71. 4 74. 3 72. 6 66. 8 51. 6 45. 8 38. 5	0 84. 9 84. 0 42. 2 57. 5 68. 8 74. 1 76. 6 74. 8 58. 6 58. 6	0 59 70 84 85 91 94 93 88 76 78	89 11 17 29 89 57 52 56 45 82 29 19	0 44. 2 48. 9 58. 1 69. 8 74. 9 84. 4 87. 3 85. 1 79. 5 65. 1 55. 8 49. 8	56. 8 34. 7 82. 1 46. 9 56. 0 67. 5 67. 5 60. 6 44. 2 89. 1 30. 9 46. 7	52. 4 68. 9 66. 8 65. 7 57. 7 44. 1 36. 8	27. 1 82. 2 42. 9 50. 8 63. 0 65. 4 65. 7 58. 4 46. 7 29. 2	25. 2 31. 4 45. 3 54. 2 64. 4 67. 4 59. 5 46. 5 40. 0	81. 2 43. 8 52. 5 63. 8 66. 9 66. 8 56. 5 45. 8 88. 7 29. 9	81 79 80 84 80 90 90 86 91 88	61 64 56 45 58 58 58 58 58 58 58 58 58 58 58 58 58	70 71 68 67 79 83 84 78 81 75 77	73 72 64 70 73 75 77 77 78 71
		(Latite	nde, 48	o 49/	N.; lo		A C.			WIS		me, 1. 0	ola 3	v, Ra	stern.	J			
J F M . A	29. 314 29. 214 29. 253 20. 292	29. 96 29. 72 29. 63 29. 54	28. 55 28. 64 28. 66 28. 77	2.7 4.4 22.2 41.3	12. 8 16. 7 82. 2 50. 3	45. 5	8. 4 11. 5 28. 0 45. 7	53 74	-25 -22 - 2 22	17. 0 19. 9 86. 4 52. 9	-0.4 2.7 20.7 28.8	-6.4 -1.7 15.8 84.0	84. 1	0. 2 6. 0 22. 4 87. 8	9. 7 19. 8 86. 1	74 76	62 65 65	67 72 75 74	65 71 71 66
M. J J 8 0 N D	29. 126 29. 204 29. 147 29. 192 29. 295 29. 199 29. 166 29. 225	29, 42 29, 52 29, 41 29, 57 29, 47 29, 51 29, 54 29, 80	28, 73 28, 82 28, 82 28, 63 29, 90 28, 62 28, 51	52.0 68.7 69.6 54.9 40.8 84.5 22.5	64. 0 72. 0 80. 6 71. 9 68. 7 53. 1 41. 5 29. 6	57. 8 66. 1 72. 5 65. 0 60. 5 46. 3 87. 9 28. 8	57. 8 67. 0 73. 9 65. 8 61. 4 46. 7 38. 0 26. 3	86 92 83 84 73 58	29 42 66 44 43 28 21 - 9	66. 9 75. 6 82. 6 78. 4 70. 0 54. 9 44. 0 83. 8	49. 1 58. 6 69. 0 58. 9 58. 7 39. 8 32. 6 19. 8		41. 9 56. 9 66. 2 58. 4 53. 4 38. 6 81. 8 22. 1	44. 7 58. 6 66. 8 58. 6 53. 8 31. 4 19. 8	42.7 57.1 65.1 57.6 52.4 37.2 39.8 19.5	94	47 56 M 60 50 70 73	64 77 89 79 72 77 75	72 75 76 74 70 75 71
Y	29. 205	29. 90	28. 51	88. 9	49. 5	44. 2	44. 2 LA	92 M.A	-25	52. 2 MO.	36. 7	<b>32.</b> 3	86. 2	34. 4	35. 0	77	2	74	71
	<del></del> 1	[Latite	1de, 87	o 32/ )	N.; lo	ngit	ide, 9	40 1	5 W	. Lo	cal ti	me, 1. 1	7 alo	v, Ea	stern.	.]		_	_
J M M J S O D Y	29, 063 28, 915 28, 945 28, 945 28, 942 28, 934 28, 951 28, 965 28, 917 29, 026	29. 38 29. 31 29. 18 29. 17 29. 11 29. 13 29. 20 29. 28 29. 27 29. 41	28. 71 28. 54 28. 54 28. 68 28. 72 28. 72 28. 65 28. 63 28. 89 28. 27	34. 0 49. 3 55. 1 66. 7 71. 0 66. 5 59. 7 45. 2 40. 6 81. 8	47. 4 62. 5 69. 8 78. 8 84. 8 82. 0 74. 5 63. 7 55. 2 42. 7	41. 0 54. 8 61. 7 70. 4 74. 6 71. 7 64. 7 51. 8 45. 7 34. 8	40. 8 55. 4 62. 0 72. 0 76. 8 73. 4 66. 8 58. 4 47. 2 36. 8	78 79 85 90 99 94 86 83 80 64	16 31 38 58 52 50 29 22 -4	52.6 66.8 72.5 81.6 88.0 84.6 77.2 66.6 59.8 46.1	81. 4 45. 9 58. 1 64. 2 65. 0 58. 0 48. 1 26. 4	50. 2 63. 1 68. 2 68. 1 57. 5 40. 8	48. 4 50. 8 65. 2 67. 9 65. 0 58. 6	65.0 68.6 68.5	29. 9 43. 8 51. 3 64. 4 68. 6 64. 9 58. 9 41. 5 33. 7 28. 8	82 84 86 91 89 86 78	58 54 58 64 58 56 09 48 48	71 71 74 88 86 86 73 67 75	76 76 78 77 80 64 72
		[Latite	ıde, 39	o 19/ 1	N. ; lo		VEN					me, 1. 5	ola O	7, Ea	stern.	<u>j</u>			
J M M J J S O N V	29, 294 29, 181 29, 181 29, 112 29, 067 29, 109 29, 087 29, 101 20, 122 29, 121 20, 100 29, 210 29, 145	29, 81 29, 60 29, 59 29, 59 29, 38 29, 29 29, 38 29, 47 29, 47 29, 61 20, 82	28. 55 28. 65 28. 81 28. 76 28. 76 28. 76 28. 82 28. 84 28. 84 28. 63 28. 44	15.7	24. 9 27. 6 48. 2 58. 5 69. 9 79. 0 86. 3 81. 4 73. 8 61. 3 50. 9 38. 2 58. 3	18. 8 21. 4 89. 6 52. 3 60. 6 70. 9 75. 5 72. 4 65. 2 41. 9 32. 9 50. 2	19. 0 21. 6 40. 1 52. 7 61. 8 72. 2 77. 9 73. 5 66. 1 52. 8 43. 5 32. 8 51. 1	56 57 70 77 88 96 98 97 85 77 75 57	-11 -16 15 80 86 51 59 52 46 30 26 2	29, 5 82, 4 51, 8 62, 7 72, 5 82, 5 84, 8 75, 5 64, 4 53, 8 41, 2 61, 6	9. 4 12. 8 30. 5 44. 9 52. 7 68. 8 68. 9 56. 0 42. 7 84. 0	11.8 12.4 28.8 42.8 49.8 61.1 66.5 55.2 59.0 81.2 22.4 40.1	17. 8 18. 7 30. 6 45. 0 51. 0 64. 8 70. 6 65. 6 41. 9 38. 5 27. 0 43. 6	15. 4 16. 7 82. 5 44. 8 52. 6 64. 5 65. 5 58. 7 42. 2 88. 8 27. 1 48. 6	15. 0 15. 9 30. 5 42. 2 51. 0 63. 5 68. 9 64. 2 57. 1 41. 0 82. 7 20. 5	35 85 85 85 85 85 85 85 85 85 85 85 85 85	75 70 52 63 53 65 59 59 59 59	80 82 76 76 75 81 82 79 80 74 72 79	85 80 71 75 76 75 75 75 76 76 77 76

### KNOXVILLE, TRNN.

 $[H=980. \lambda=77.]$ 

		dir		•						Wi	nd.	(A	_ w		-	=71	••	Prec	ipi-	<u> </u>	Nı	amt		of (	ley	_		Τ
7. B.	8 p. m.		11 P. III.	Mean.	Table (miles)	Total (mines).	Maximum.	Direction.	North.	Northeast.	East.	Southeast.	South.	Southwest.	West.	Northwest.	Calms.	Total	Max. 24 hours.	Clear.	Fair.	Cloudy.	Rain or snow.	Max. below 82°.	Min. below 32°.	Max. above 900.	Thunder-storms.	Months and year.
8.29 8.49 8.49 8.48 8.48 8.75 8.75	6664664675655	3 4 4 3 2 4 4 5 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4	1 2 7 5 4 8 2 2 8 4 2 0 0	5.540 4.00 5.40 5.40 5.60 5.50 5.50	K4448888388447	517 708 173 568 694 370 834 281 621 570 548 986 830	36 32 31 27 23 26 24 27 27 21 33	W. W. W. SW. NW. NE. W. W. W.	20 18 14 12 16 16 17 12 15 12 18 11	28 8 11 9 8 10 15 13 21 23 9 10 165	4	2 0 1 2 1 3 3 4 1 0 4 5 26	5 1 1 5 8 6 4 8 1 7 2 3	7 21 14 14 15 17 20 29 14 8 176	23 21 23 23 13 13 10 11 17 26 23 37 240	5 4 11 8 11 3 6 3 2 5 10 10 78	1 6 17 7 14 12 14 18 2 3 2 4	3. 10	0. 98 1. 29 0. 79 1. 48 1. 57 2. 35	10 11 14 11 9	11 7 11 11 9 14 17 18 11 9 16 138	11 10 5 11 6 2 7 12 11 13 9	11	00000000	18 18 13 0 0 0 0 0 5 17 73	11 4 0 0 0	1 0 2 12 16 7 1 2 3 0 55	0 J. 0 F. 0 M. 0 J. 0 J. 0 J. 0 V. 0 V. 0 V.
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LEWISTON, IDAHO.

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Months and year.	Moan.	Maximum.	Minimum.	7 a. m.	8 p. m.	11 р. m.	Mean.	Maximum.	Minimum.	Maximum.	Minimum.	7 a.m.	8 p. m.	11 p.m.	Mean.	7 a. m.	8 7 E.	11 p.m.	Meen.
J F M J J	In. 29, 375 29, 257 29, 857 29, 155 29, 109 29, 121 29, 108 29, 136	In. 29. 86 29. 71 29. 64 29. 45 29. 38 29. 39 29. 32 29. 41	In. 28, 89 28, 85 29, 00 28, 78 28, 94 28, 78	o 20. 4 85. 8 39. 0 43. 6 52. 2 57. 2 63. 8 60. 0	62. 0 66. 2 71. 4 81. 8	o 23. 8 39. 4 50. 9 57. 4 62. 8 68. 8 79. 5 77. 3		58 72 81 87 91	-10 23 - 30 81 42 47 53 51 41	81. 3 47. 1 62. 3 69. 4 78. 8 77. 8 87. 9 88. 2 76. 4	55. 1 61. 0	0 15. 2 30. 4 33. 4 36. 6 44. 7 51. 7 55. 0 50. 2	45. 6 52. 7 51. 0	0 19.8 82.7 88.4 86.2 46.8 54.9 51.8 45.6	85. 4 45. 7 58. 1 52. 6	77 76 82	77 69 53 86 50 53 86 34 46	83 78 64 48 50 64 40 25	80 76 60 53 67 50 46 58
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		[Lati	tude, 3	40 %	N. ; l					8, C. 7. L		ime, 2	.58 alc	w, Be	etern	]			
J M J 80 DY	29. 750 29. 687 29. 693 29. 623 29. 561 29. 623 29. 610 29. 472 29. 540 29. 647 29. 647 29. 648	30. 01 29. 91 29. 94 29. 83 29. 67 29. 74 29. 62 29. 75 29. 83 29. 93	29. 53 29. 42 29. 44 29. 47 29. 89 29. 33 29. 44 29. 35 29. 48	51. 8 54. 8 55. 0 60. 4 63. 4 59. 5 54. 5 53. 1 52. 8	71. 6 71. 6 77. 9 88. 4 86. 5 77. 7	54. 6 58. 8 59. 7 60. 7 62. 2 66. 2 66. 1 62. 8 57. 8	56. 60. 61. 63. 65. 65. 60. 66. 66. 66. 65. 65. 65. 66. 66. 65. 66. 66	8 81 8 85 8 86 8 80 9 90 9 98 7 106 5 108 8 102 5 78	86 42 45 45 47 47 52 51 51 51 40 40	74. 1 74. 2 76. 8 80. 8 85. 8 84. 9 69. 1 68. 2	44. 49. 8 52. 5 54. 7 58. 6 61. 4 56. 6 52. 8 50. 8 48. 6	89.43.49.65 49.65 50.56.56.56.56.56.56.56.56.56.56.56.56.56.	8 43.0 5 45.1 0 50.1 0 55.1 1 54.0 2 60.1 3 62.0 5 62.1 5 60.2	51. 55. 55. 55. 55. 55. 55. 55. 55. 55.	48. 46. 50. 554. 58. 60. 58. 59. 59. 51. 56. 51.	75 75 85 85 85 85 85 85 85 85 85 85 85 85 85	477 448 499 545 455 456 457 548 557 568 568 568 568 568 568 568 568 568 568	77 76 76 78 83 77 79 87 91 80 80	76 75 75 76 76 76 78 78
		[Lati	tude, 8	8° 15′	N.;	longit				E, K. V. L		ime, 0	.43 alc	w, E	aston	n.]			
J M J 8 D V	29. 594 20. 453 29. 525 29. 441 20. 866 29. 482 29. 402 29. 476 29. 416 29. 426 29. 584 29. 461	29.97	29. 11 29. 02 28. 92 29. 17 29. 28 29. 05 29. 08 28. 96 29. 04 28. 77	25. 2 34. 5 51. 2 50. 2 67. 9 78. 7	35. 0 44. 2 64. 8 71. 9 80. 6 87. 6	40. 1	29.	9 66 6 78	3 - 1 125 125 3 31 5 45 5 45 6	88.8 47.6 68.8	20. 4 81. 4	19.	5 25. 5 80. 0 46. 5 53. 0 66. 6 63. 1 63. 1 63. 1 63. 1 63. 1 63. 1 7 32.	9 24. 1 22. 1 5 30. 1 6 48. 1 7 65. 6 3 59. 1 3 48. 1 3 39. 6 4 6. 6	24. 22. 3 29. 46. 5 53. 6 63. 6 64. 5 64. 5 58. 4 7. 5 58. 4 7. 5 45.				

LEWISTON, IDAHO. [H=785, h=43.]

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7 th IB.	8 P.B.	11 p.m.	Mean.	Total (miles).	Maximum.	Direction.	North.	Northeast.	East.	Southeast.	South.	Southwest.	West.	Northwest.	Calma.	Total	Max. 24 bours.	Clear.	Fair.	Cloudy.	Rain or snow.	Max. below 82º.	Min. below 82°.	Max. above 90°.	Thunder-storms.	Auroras.	Months and year.
1.5	1.4 3.0 3.2 5.9	1 1 1 5 5 5	2.8 2.8 6.8 6.6	1, 05 1, 610 1, 96 977 68 1, 21 1, 04 2, 18 1, 33 2, 01 2, 62	3 29 3 22 9 25 3 28 4 32 3 26 3 19 0 20 4 26	NE. NW. NW. NE. NW. NW. SW. SW. NW.	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	15 18 13 14 2 10 17 15	8 0 2 2 0 3 0 1 0	24 27 25	0 0 1 1 0 0 0 1 0 0 2 0 0 5	3 9 4 5 4 8 12 7 22	0 0 1 3 0 1 0 1 1 0 0 0 1 7	2 11 15 8 7 26 15 8 5	27 31	2.8 0.5 0.1 8.0 4.9 0.4 0.6 0.7 2.1 2.2	In. 7 0. 6 8 0. 9 8 0. 4 9 0. 1 2 0. 7 1 1. 7 2 0. 0 1 0. 1 6 0. 2 1 0. 8 3 0. 6 1 0. 5 4 1. 7	6 24 1 26 8 1 2 10 8 2 7 2 4 1 7 2 5	1 17 1 10 1 10 1 10 1 10 1 10 1 10 1 10	8 7 8 10 8 10 10 10	2 7 1 5 1 9 1 9 1 1 2 1	1 0 B 0 B 0	120	2 0 3 0 1 0 0 0 0 1 0 10 0 0 1 0 0 0	0 0 0 0 0 0 0	0 0 0	J. A. S. O. N. D.
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5.8 5.6 5.6 5.4 4.5 4.3 5.5 5.4 5.4 5.7 5.4 5.4 5.4 5.4 5.4 5.4 5.4 5.4 5.4 5.4	4. 9 5. 6 5. 6 4. 1 7. 7 6. 2 4. 5 6. 2	4.5.4.3.3.2.4.4.3.3.3.3.3.3.3.3.3.3.3.3.3.3	3 5, 2 5 5, 0 8 5, 0 8 5, 1 8 3, 7 1 3, 9	3, 97 3, 54 3, 30 4, 10 4, 17	3 20 8 24	NE. N. SE.,SW	13	8 166 166 166 166 166 166 166 166 166 16	5 13 9 9 1 3 1 0 1 3 2 4 5 15 4 10 7 11 5 7	5 2 18 11 2 14 5 13 10 7	100 211 160 100 188 19 233 24 100 113 113	9 11 9 10 9 18 18 18 18 18 18 17 17 17 17 18 18 18 18 18 18 19 19 19 19 19 19 19 19 19 19 19 19 19	10 11 11 11 11 11 11 11 11 11 11 11 11 1	5 12 1 15 15 15 15 15 15 15 15 15 15 15 15 1	2 1 1 2 2 7 2 2 7 2 1 1 1 7 1 1 1 1 1 1	5 2.4 8 3.8 3 6.0 1 3.2 5 3.3 8 1.1 2 1.9 6 2.0 7 2.0	11 1. 6 3 1. 4 4 0. 9 8 1. 5 96 1. 5 13 0. 6 95 0. 6 1. 19 1. 10 1. 10 1	59 19 25 24 15 1 183 1 81 197 1	8 1 9 1 9 1 3 1 4 1 7 1 3 1 4 1 2 1	8 3 4 5 5 5 4 3 5 1 1 1 5	3 1 8 1 7 1 6 1	8 1 1 1 1 1 1 1 1 7 7 7 8 6	0 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 1	5 0 0 0 0 0 1 0 2 0 1 0 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1 2 0 1	6 8 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6	000000000000000000000000000000000000000	F. M. A. M. J. J. A.
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28 SW., W 30 SW., W 20 NW. 28 W. 22 SW.

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28 25

SW. SW. NW. SW. NW. W.

6,041 5,055 6,198 5,886 5,329 5,452 4,478 5,218 4,226 4,892 5,903 7,100 65,788

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5 6 6 5 13

93 57 127 175 193 138 107

19 

# Monthly and yearly meteorological summaries—Continued. LYMCHBURG, VA. [Latitude, 87° 25' N.; longitude, 79° 9' W. Local time, 0.16 slow, Eastern.]

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Months and year.										Me	an.								
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onth	Mean.	Maximum	Minimum	ë ë	p. m.	p H	Meen.	Maximum	Minimum	Maximum	Minimum	e e	P. B.	ų.	Mean.	ij	ij	11 P. B.	Meen.
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M .	29. 849 29. 357	29. 76 29. 90	28. 98 28. 93 28. 82	82. 9 48. 6	46. 8 64. 9	30. 4 37. 9 53. 4	81. 6 89. 0 55. 0	61 71 85 85	17 82	40.8 48.4 67.2	23. 8 80. 9 43. 9	19. 6 25. 8 89. 5	23. 7 27. 1 39. 1	27. 6 28. 1 29. 0 41. 8	37.1 40.1	74	49 42	71	73 65 65 70 70 73 73 80 78
М. Ј Ј	29. 265 29. 865 29. 825	29. 49 29. 63 29. 53	28, 82 28, 98 29, 69	58. 2 69. 1 72. 5	71. 8 80. 6	60. 7 70. 2	63. 4 78. 8	85 93 97	40 52	73. 2 82. 9 87. 8	54. 9 63. 9	52. 8 60. 6 65. 5	49.5 60.6 64.7	53. 8 62. 7 68. 6	51.7 61.8 66.3	81 75 .79	51 52 50	78 78	70
A	29. 816 29. 402	29. 56 29. 68	28. 96 28. 94	72. 5 69. 5 60. 4	86. 4 83. 0 76. 9	74, 1 71, 9 64, 8	77. 7 74. 8 67. 4		54 51 46	84.7 77.8	67. 6 66. 3 58. 6	65, 5 64, 8 55, 5 43, 9	68. 8 55. 3	65. 6 58. 6	64. 6 56. 5	84 85	54	71 66 78 78 63 81 81 80 63	77
N	29. 317 29. 299	29.66 29.70	28. 58 28. 95	47. 0 89. 7	63. 5 58. 5	50. 2 43. 2	58. 6	74	84 28	65. 6 54. 8	44. 1 86. 9	43. 9 35. 8	49. 8 40. 7	46. 9 88. 8	46. 9 88. 8	90 87	83	80 83	80 78
D	29. 879 29. 842	30. 08 30. 00	28. 71 28. 58	84.1 49.1	47. 0 62. 6	37. 8 52. 4	89. 6 54. 7	65 97	16 4	49. 4 64. 7	81. 8 45. 8	26. 6 43. 0	28. 8 44. 8	20. 5 45. 4	28. 8 44. 2	75 80	51 54	72	71
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# Monthly and yearly meteorological summaries—Continued. LYNCHBURG, $\forall A$ . [H = 452. $\lambda$ = 50.]

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# Monthly and yearly meteorological summaries—Continued. MARQUETTE, MICH.

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### Monthly and yearly meteorological summaries—Continued. MARQUETTE, MICH.

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		dine					W	nd.								Prec			N	ımb	er (	of	day	8-		
7 a. m.	9 p. m.	11 р. та.	Mean.	Total (miles).	Maximum.	Direction.	North.	Northeast.	East	Southeast.	South.	Southwest,	West.	Northwest,	Calma.	Total.	Max. 24 hours.	Clear.	Fatr.	Cloudy.	Rain or snow.	Max. below 329.	Min. below 320,	Max. above 90°.	Thunder-storms.	Autoras.
5. 1 3. 4 3. 2 3. 8 6. 7 5. 5 8. 0 9. 61 7. 8	5.3 4.5 5.1 5.3 5.8 4.0 6.5	5, 4 3, 8 3, 2 4, 3 5, 3 7, 5, 8 9, 0 7, 8	4.7 5.3 3.9 4.5 4.7 6.8 9.2 1	5, 604 5, 349 5, 419 4, 844 6, 024 7, 027 6, 646	34 28 29 31 30 25 36 36 27	NW.  NW.  S.NW.  SW.  W.  SE. W.  S.  SW.  W.  NE.  W.  NE.  W., S.	24 14 4 1 2 3 5 15 13 7	11 10 8 7 7	1 4 12 11 12 10 2 7	1 6 12 9 11 9 12 8 3 4	9 7 11 4 5 11 7 11 11 16 9	13 7 5 12 10 13 9 19 14 8 20	10 4 19 17 17 25 27 26 30	25 31 30 19 20 11 16 9 10 13 15	4 0 74800000	2.14 1.90 3.19 3.34 1.85 2.47 1.00 2.91 4.10 1.87	0. 60 1. 68 1. 34 0. 63 0. 79 0. 30 0. 96 1. 69	11 12 15 11 8 4 9 5 0	14 16 17 15 11 3	7 11 7 5 7 10 6 15 27 19		6 0 0 0 0 0 0	31 23 11 0 0 0 0 13 19 31		0 0 4 4 1 2 0 1 0	J 1 1 2 J 0 J 1 2 3 S 3 O 0 I N 0 I L Y
		7 13 1						9		EM H=		-	TI A ==								9.91			_1	1	1
1. 5 3 5 1 2 4 4 4 4 5 3 4 5 5 3 5 1 2 4 5 1 5 1 5 1 5 1 5 1 5 1 5 1 5 1 5 1 5	1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2	3.0 3.8 4.4 3.7 3.7 3.7 4.3 4.4 3.7 4.5 3.4 4.4	5.0 4.4 3.5 4.8 3.5 4.5 4.6	4, 530 5, 603 5, 590 3, 544 3, 842 3, 261	28 38 34 24 28 23 21 20 26 22	NW. NW. NW. NW. NW. SW. SW. (SW., SW. (NW., SW.	8 4 10 3 1 7 4 11 6 3 4 2 63	18 15 5 13 10 13 4 11 22 11 4 13 139	6 4 6 5 9 2 9 1 5 6 2 3	15 8 13 27 14 10 10 4 14 14 15 23	8 9 10 7 3 11 15 15 5 5 8 4	7 11 12 10 15 23 14 14 5 9 12 11	12 14 12 8 16 12 14 14 7 25 25 24	19 17 24 17 22 12 15 22 24 17 19 9	0 2 1 0 3 0 8 1 2 3 1 4	6. 61 1. 88 3. 07 3. 00 3. 05 1. 52 4. 80 1. 70 4. 42 1. 18 3. 26 2. 92 37. 41	0, 02 1, 49 0, 79 1, 93 0, 50 1, 63 1, 70 1, 21 0, 37 1, 68 1, 07	11 10 9 8 10 14 14 14 9 15 13 10	13 14 16 16 13 15 13 15 12 6 15	10 68 77 74 44 22 8 4 11 6 77	10 7 13 12 11 8 11 1 1 1 8 10 7 109	6200000000000000	0	20 1 14 0 0 0	6 4 1 1	0 J 0 F 0 M 0 A 0 J 0 J 0 J 0 O 0 S 0 O 0 O 0 O 0 O 0 O 0 O 0 O 0 O 0 O 0 O
								1		LW #=			EE,			1							- 1	J	1	
65 66 45 65 76 76 76 88 88 48	12 ( 2 ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 ) ( 1 )	4.5 4.5 4.1 4.1 4.0 6.5 7	5.4 6.0 6.0 6.0 6.0 6.0 7.3 6.7 6.7 7.3	8, 606 8, 960 8, 999 6, 929 6, 363 7, 792 7, 500 7, 989	41 45 40 53 36 30 38 38 33 44	NW. NW. NW. SW. SW. NW. NW. NW. NE. NE. W.	9 7 11 19 27 16 11 12 9 20 12 6 159	1 5 9 15 12 5 12 11 9 7 6 7	9424	4	11 9 7 13 11 17 11 9 15 5 10 9	22 12 16 10 10 11 16 8 17 18 10 20	27 24 16 3 11 11 8 17 13 10 24 25 189	29 19 18 12 5 7 10 6 9 18 20 14	3	1. 10 4 0. 49 0 0. 21 2 2. 32 2 0. 41 0 6. 49 4. 23 0 7. 30 1 2. 40 0 1. 53 0 2. 71 0 2. 58 2	0, 14 0, 09 1, 02 0, 19 1, 83 0, 91 2, 09 1, 74 0, 81 0, 88 0, 77	14 9 6 3 11 9 5 11 14 8 2 3 95	9 17 14 12 18 21 10 7 10 15 18 159	9 10 8 13 8 3 5 10 9 13 13 13 10	11 7 8 11 8 13 17 14 7 8 10 15 129 7	23 15 0 0 0 0 0 0 0 1	31 28 29 9 2 0 0 0 1 14 23 37	0 0 0 0 0 0 0 0 0 0 0	0 0 0 1 6 0 1 2 0 2 0	0 J. 0 F 1 M 0 A 0 J. 0 J. 0 J. 1 S. 0 O. 0 D. 0 D. 0 D.
										10E #=		•	AL =8													
77033555563835	23 64 62 33 42 71 82	L34 L24 L24 L25 L04 L43	L 3 L 2 L 7 L 4 L 7 L 8 L 1	5, 910 5, 576 4, 193 5, 230 4, 902 3, 903 3, 944 4, 824 4, 824 5, 502 6, 090 6, 090	32- 26 21 32 32 24 44 25 28	SE. SW. W. SE. NE. SE. NE. W. E. S.	29 29 23 12 11 8 15 16 19 27	11 10 3 4 3 5 13 16 9 1	9324322453366	111 17 9 11: 11, 5	10 16 14 17 28 11 12 12 12 16 18 10 66	5 9 5 8 6 5 12 9 6 6 3 8 8 2	6	7: 16:1 11: 15: 22: 31: 30:	10 11 16 12 12 10 3 1 11 11	1. 95 3 2. 85 1 6. 36 1 5. 24 3 3. 27,1 4. 10 1 3. 81 0 6. 07 1 9. 25 3 1. 19 0 4. 83 1 5. 00 4 4. 00 4	. 43 . 92 . 43 . 93 . 66 . 49 . 53 . 66	13 13	10 12 21 22 23 23 17 18 12 11	11 7 9 4 4 1 1 2 4 8 5 6 4 6 5 1	11 12 15 20 16 6 8	0000000000000	0 0 0 1	0 0 0 0 4 1 9 1 0 0		J. 0 M. 0 M. 0 J. A. 0 N. 0 Y. 0 Y.

#### MONTGOMERY, ALA.

[Latitude, 32° 22' N.; longitude, 86° 18' W. Local time, 0.45 slow, Eastern.]

	Pr	esure.				Ter	npern	tur	в.			]	Dew 1	oint.				tive idit	
nd year.		a						n.	d	Me									
Months and	Mean.	Maximum.	Minimum	78.田.	3 р. ш.	11 p.m.	Mean.	Maximum	Mimimum.	Maximum.	Minimam	7 a. m.	3 p. m.	11 р. ш.	Mcan.	7 a. m.	8 p. m.	11 p.m.	Mean.
J M M J J S O D Y	In. 29, 969 29, 839 29, 912 29, 842 29, 832 29, 832 29, 876 29, 774 29, 788 29, 842 20, 964 26, 841	In. 30, 33 30, 22 30, 31 30, 18 29, 94 29, 98 30, 01 29, 99 29, 98 30, 05 30, 10 30, 37	In. 29. 50 29. 21 29. 57 29. 57 29. 39 29. 58 29. 58 29. 54 29. 40 29. 48 29. 46 29. 21	88. 7 44. 0 58. 3 64. 3 74. 2 75. 0 74. 5 70. 1 53. 9 48. 1	52. 6 59. 7 74. 8 77. 7	45. 0 51. 4 64. 4 68. 2 77. 7 77. 7 73. 7 59. 5 52. 9 45. 5		79 76 86 89 95 95 91 79 79	15 26 38 48 63 63 65 55 40 31 25	55. 2 55. 6 62. 2 76. 8 80. 4 90. 6 91. 0 89. 3 83. 2 70. 7 63. 8 57. 2 73. 0	35. 4-40. 5 55. 6 61. 2 70. 3 71. 7 71. 7 68. 2 51. 9 45. 4 36. 6	36. 3 33. 1 39. 3 52. 6 58. 4 69. 2 71. 1 72. 3 67. 7 50. 3 44. 2 33. 3 52. 3	33. 7 37. 8 49. 6 58. 1 67. 3 70. 8 72. 3 69. 8	53, 0 45, 6 36, 4	58. 7 68. 8 71. 5 72. 4 69. 1 51. 3 43. 6 84. 6	84 82 82 85 88 93 92 88 87	48 44 54 53 59 63 69 54 51 48	70 70 67 75 78 85	75 67 64 71 72 77 80 83 74 72 66 72

#### MONTROSE, COLO.

[Latitude, 38° 30' N.; Longitude, 107° 56' W. Local time, 2.12 slow, Eastern.]

J F M M J	24. 178 24. 851 24. 223 24. 237 24. 804	24. 63 24. 47 24. 41 24. 48	24. 03 23. 90 24. 09 23. 90	29. 0 38. 4 43. 2 50. 2	50. 9 54. 2 64. 7 74. 0	38. 1 44. 6 53. 1 62. 1	39. 3 45. 7 53. 7 62. 1	68 73 84 86	16 27 34 38	55. 5 59. 6 69. 4 78. 9	27.8 37.2 42.4 49.7	25, 6 83, 6 34, 3 86, 5	25. 7 83. 2 28. 3 29. 0	24. 5 27. 4 35. 4 35. 4 36. 0	20. 2 84. 1 82. 7 33. 8	87 84 72 61	41 51 28 23	67 72 54 40	69 51 41
J		24, 50	24, 27	57. 2	81. 6	68. 9	69. 2	96	50	86, 6	56. 2	46.3	45. 3	48. 5 49. 3	46.7	68	31	50	50
A 8	24. 348	24.43	24.04	47. 2	74.0	58. 2	59.8	86	31	77.5	45.7	39.1	37.6	39.1	38.6	74	80	51	52
Ŋ	24. 373 24. 316	24. 61	23.72	27. 3	48.8	35. 8	37. 3	69	13		25. 5	21.1	24.7	29. 8 26. 5	24. 1	77	42	70	63
Т	24. 866	24, 74	23.77	18. 7	36. 9	26. 8	27. 5		-10	40.8	17. 6	14. 1	24. 5	21.7	20. 1				
					l	!									·				

#### MOORHEAD, MINN.

[Latitude, 46° 52' N.; Longitude, 96° 44' W. Local time, 1.27 slow, Eastern.]

									1						1 1	1	1	1	$\neg$
J	29. 075	29. 66	28. 41	-5. 4	4.8	-1.7	-0.8	43	-35	9. 9	-11. 5	-12.5	-3.6	-9.4	-8.5			72	73
F	29. 018	29.45	28.44	-4.2						14.6	- 7. 1	-12.1	0. 5	-5. 5	-5.7		69	80	71
М.	29. 061	29. 50	28. 35				22. 5				12.3				14.0			71	69
A	28. 943	29. 34	28, 30		48. 2										33. 2			79	76
М.	28, 903						52. 6				41.8				42.8			77	
J	28. 954										51.4		58.3					86	
J	<b>28.</b> 896																	87	
A	28. 980		28. 54								49. 1		52.3	52.6	51. 2	93	53		
8	28. 918		28. 33							71.8		42.0	45. 8	<b>45.</b> 8	44. 5	89	45	74	
0	28.978		28. 57								28.6				81.5			76	
N																	81		
D	28.988		28, 33				15. 3						15.7						90
Y	28. 974	29. 66	28.30	30.7	45. 2	36. 2	37.4	92	-35	49. 1	27.0	26. 9	82.4	30. 2	29.8	86	64	80	77
												i				1		1	- 1

#### MOUNT WASHINGTON, N. H.

[Latitude, 44° 16' N.; longitude, 71° 16' W. Local time, 0.15 fast, Eastern.]

J	23, 292	23, 79	22.61	1.0	2.2	-1.1	0.7	37	-50	11.5	-12.9	3.2	4.5	-0.7	2.3	94	98	94	55
F	23, 253						0.6	32	-38	8. 6	-10.0			0.0				90	90
М.	23, 302									14.4				-0, 9				91	191
A	23. 595														20, 4				51
М.	23, 768														29, 9				
J	23,783														38, 8				
J	23, 889									54.9					44. 9			92	
A	23, 853									49.5					39. 6				
8	23, 812									45.0					34, 1				
0	23.732									36.4					27. 6			294	
N	23, 512	23, 94	22, 19	21.1	22, 0	21. 2	21, 4	51	6	27.6	15. 8	19. 7	20. 6	20, 2	20, 2	95	394	26	95
D	23, 371	23. 97	22,62	9. 6	10.6	10.1	10.1	42	-16	18.8	1.5	8.4	9. 2	9, 3	9. 0	95	94	96	95
Y	23. 597	24. 15	22.52	23,4	26.0	23.7	24.7	69	-50	32.7	17. 1	21.0	24.1	21.9	20 3	50	89	92	90

8 78. 37 4. 61 154 177 34 197 172 245 0 11 14 Y

#### Monthly and yearly meteorological summaries—Continued.

#### MONTGOMERY, ALA.

[H = 219.  h = 58.]		
Cloudiness (in tenths).	Wind. Precipitation.	Number of days—
7 a. m. 8 p. m. 11 p. m. Mean.	Total (miles).  Maximum.  Direction.  North.  North.  East.  East.  South west.  South west.  North west.  Calms.  Total.  Gat. 24 bours.	Fair. Cloudy. Rain or snow. Max. below 820. Min. below 820. Min. below 820. Thunder-storns. Aurora.
7.0 6.5 6.2 6.4 5.3 5.2 8.74.7 4.5 4.5 3.2 4.1 5.1 3.3 3.75.1 4.2 5.1 2.84.0 6.1 5.94.7 3.3 5.8 6.65.1 3.8 5.64.8 2.2 9.4 5.64.5 2.3 4.4 6.5 2.3 4.4 6.5 3.3 9.4	6 5, 341 29 W. 21 13 14 7 4 9 7 16 2 9.72 3.13 (7 4, 617.77 W. 18 6 6 5 9 10 13 13 4 3 68 1.19 11 4, 117,23 E., NW. 15 3 5 10, 5 15 4 2 4 12 2.93 0.58 1.9 11 3, 543 23 NW. 4, 79 12 11 14 18 5 3.92 1.74 (8.92 2.39 1 NW. 15 11 5 12 8 13 6 8 12 4 32 2.51 10 2.94 23 NW. 15 11 5 12 8 13 6 8 12 4 32 2.51 10 2.94 23 NW. 15 11 5 12 8 13 6 8 12 4 32 2.51 10 2.94 23 NW. 15 11 5 12 8 13 6 8 12 4 32 2.51 10 2.94 23 NW. 15 11 5 12 8 13 6 8 12 4 32 2.51 10 2.94 23 NW. 15 11 5 12 8 13 6 8 12 4 32 2.51 10 2.94 23 NW. 15 11 5 12 8 13 6 8 12 4 32 2.51 10 2.94 23 NW. 15 11 5 12 8 13 6 8 12 4 32 2.51 10 2.94 23 NW. 15 11 5 12 8 13 6 8 12 4 32 2.51 10 2.94 10 2.94 10 2.94 10 2.94 10 2.94 10 2.94 10 2.94 10 2.94 10 2.94 10 2.94 10 2.94 10 2.94 10 2.94 10 2.94 10 2.94 10 2.94 10 2.94 10 2.94 10 2.94 10 2.94 10 2.94 10 2.94 10 2.94 10 2.94 10 2.94 10 2.94 10 2.94 10 2.94 10 2.94 10 2.94 10 2.94 10 2.94 10 2.94 10 2.94 10 2.94 10 2.94 10 2.94 10 2.94 10 2.94 10 2.94 10 2.94 10 2.94 10 2.94 10 2.94 10 2.94 10 2.94 10 2.94 10 2.94 10 2.94 10 2.94 10 2.94 10 2.94 10 2.94 10 2.94 10 2.94 10 2.94 10 2.94 10 2.94 10 2.94 10 2.94 10 2.94 10 2.94 10 2.94 10 2.94 10 2.94 10 2.94 10 2.94 10 2.94 10 2.94 10 2.94 10 2.94 10 2.94 10 2.94 10 2.94 10 2.94 10 2.94 10 2.94 10 2.94 10 2.94 10 2.94 10 2.94 10 2.94 10 2.94 10 2.94 10 2.94 10 2.94 10 2.94 10 2.94 10 2.94 10 2.94 10 2.94 10 2.94 10 2.94 10 2.94 10 2.94 10 2.94 10 2.94 10 2.94 10 2.94 10 2.94 10 2.94 10 2.94 10 2.94 10 2.94 10 2.94 10 2.94 10 2.94 10 2.94 10 2.94 10 2.94 10 2.94 10 2.94 10 2.94 10 2.94 10 2.94 10 2.94 10 2.94 10 2.94 10 2.94 10 2.94 10 2.94 10 2.94 10 2.94 10 2.94 10 2.94 10 2.94 10 2.94 10 2.94 10 2.94 10 2.94 10 2.94 10 2.94 10 2.94 10 2.94 10 2.94 10 2.94 10 2.94 10 2.94 10 2.94 10 2.94 10 2.94 10 2.94 10 2.94 10 2.94 10 2.94 10 2.94 10 2.94 10 2.94 10 2.94 10 2.94 10 2.94 10 2.94 10 2.94 10 2.94 10 2.94 10 2.94 10 2.94 10 2.94 10 2.94 10 2.94 10 2.94 10 2.94 10 2.94 10 2.94 10 2.94 10 2.94 10 2.94 10 2.94 10 2.94 10 2.94 10 2.94 10 2.94 10 2.94 10 2.94 10 2.94 10 2.94 10	5 9 7   12 0 2 0 3 0 M. 9 17 4 8 0 0 0 0 5 0 M. 0 9 12 13 0 0 0 5 0 M. 6 21 1 9 0 0 21 2 0 J. 4 21 6 21 0 0 21 10 0 J. 7 17 7 13 0 0 14 6 0 A. 7 12 11 15 0 0 1 4 0 S. 4 10 7 6 0 0 0 0 0 0 O. 2 10 8 10 0 1 0 3 0 N. 2 11 8 5 0 9 0 1 0 1 0 N.
MONTROSE, COLO. $ (H = 5825, h = 22.) $		
5.86.55.45.8 3.14.5.3.23.6 5.77.05.28.5 1.96.43.74.6 3.25.33.64.6 2.95.13.23.7 2.23.42.32.6 4.65.04.74.8 4.95.45.35.2	9 3, 058 28 NW. 9, 4 16 12 2 5 4 16 1 0.22 0.10 6 4, 996 36 NW. 4 6 39 10 2 4 14 14 0 0.67 0.19 1 0.5, 634 38 SW. 4 0 9 24 4 19 20 13 0.86 0.29 1 0 7, 993 50 SW. 0 0 6 34 9 26 11 4 0 1.02 0.59 1 0 5, 634 44 SW. 4 214 32 6, 13 17 5 0 1.09 0.38 1 7 5, 518 38 SW. 4 0 9 24 4 19 20 13 0 0.86 0.29 1 6 5, 634 44 SW. 4 214 32 6, 13 17 5 0 1.09 0.38 1 7 5, 518 38 SW. 4 219 9 15 9 1 2 23 0.92 1 6 5, 607 36 SE, SW. 5 2 5 4 3 6 10 13 6 0 0.53 0.15 1 6 4, 616 25 SW. 4 219 44 2 1 1 2 27 1 0.56 0.37 2 8 4, 020 38 SW. 4 219 44 2 1 1 2 27 1 0.56 0.37 2 8 4, 020 38 SW. 4 219 44 2 1 1 2 27 1 0.56 0.37 2 8 4, 020 38 SW. 4 219 44 2 1 1 2 7 1 0.56 0.37 2 8 4, 020 38 SW. 4 219 44 2 1 2 1 2 27 1 0.56 0.37 2 8 4, 020 38 SW. 4 219 44 2 1 2 1 2 27 1 0.56 0.26 1 2 3, 548 34 SW. 9 1 9 35 6 3 7 18 3 0.71 0.27 1	31 19 8 20 0   3 0 4 0 A. 2 15 4 7 0 0 0 0 7 0 M. 3 14 3 4 0 0 0 7 4 0 J. 3 11 7 10 0 0 7 14 0 J. 5 11 5 1 1 0 0 7 14 0 J. 8 10 2 6 0 1 0 0 9 0 S. 0 1 0 10 7 0 27 0 0 0 N.
MOORHEAD, MINN. $[H=923. \ h=4L]$		
2 45. 42 23.4 2 85. 73. 44. 6 86. 03. 95. 5 66. 44. 05. 5 97. 1!4. 35. 5 95. 94. 115. 2 94. 53. 03. 6 67. 06. 06. 5 66. 84. 35. 4. 98. 23. 95.	3 6, 152 38 8. 13 2 0, 2 18 15 10 23 10 0.02 0.02 1 0 6 8, 764 44 N. 42 7 2 5 7, 815 6 0 0.31 0.24 3 9, 273 40 NW. 27 7 4 16 20 6 2; 8 0 3.43 1.63 6 8, 440 40 N. 24 13, 1 11 19 6 6; 11 2 2.27 1.18 8 6, 695 42 SE. 18 10 1 16 18 11, 7, 7; 2 7.02 2.60 14 6, 466 51 N. 17 7 7 17 18 7.7 11 2 3.33 1.04 6, 605 140 SE. 22, 7 5 11 21 7 5 14 1 1.47 0.53 1 5 7, 332 32 N. 20 6 3 2 9 21 4 13 14 1 0.64 0.23 1 7, 334 42 8 5 26 3 2 9 21 4 13 14 1 0.64 0.23 1 0.35 6 8, 720 50 S. 20 41 1 9 28 9 8 13 1 0.32 0.10 89, 039 262 74 32 125 223 105 97 148 28 22 68 1.63 10	3
MOUNT WASHINGTON, N. H. $[H=6,279.  \lambda=2.]$		
3.01.92.42.42.42.42.42.43.43.23.44.33.84.53.84.52.75.03.43.54.53.84.53.84.53.84.53.84.53.84.53.84.53.84.53.84.53.84.53.84.53.84.53.84.53.84.53.84.53.84.53.84.53.84.53.84.53.84.53.84.53.84.53.84.53.84.53.84.53.84.53.84.53.84.53.84.53.84.53.84.53.84.53.84.53.84.53.84.53.84.53.84.53.84.53.84.53.84.53.84.53.84.53.84.53.84.53.84.53.84.53.84.53.84.53.84.53.84.53.84.53.84.53.84.53.84.53.84.53.84.53.84.53.84.53.84.53.84.53.84.53.84.53.84.53.84.53.84.53.84.53.84.53.84.53.84.53.84.53.84.53.84.53.84.53.84.53.84.53.84.53.84.53.84.53.84.53.84.53.84.53.84.53.84.53.84.53.84.53.84.53.84.53.84.53.84.53.84.53.84.53.84.53.84.53.84.53.84.53.84.53.84.53.84.53.84.53.84.53.84.53.84.53.84.53.84.53.84.53.84.53.84.53.84.53.84.53.84.53.84.53.84.53.84.53.84.53.84.53.84.53.84.53.84.53.84.53.84.53.84.53.84.53.84.53.84.53.84.53.84.53.84.53.84.53.84.53.84.53.84.53.84.53.84.53.84.53.84.53.84.53.84.53.84.53.84.53.84.53.84.53.84.53.84.53.84.53.84.53.84.53.84.53.84.53.84.53.84.53.84.53.84.53.84.53.84.53.84.53.84.53.84.53.84.53.84.53.84.53.84.53.84.53.84.53.84.53.84.53.84.53.84.53.84.53.84.53.84.53.84.53.84.53.84.53.84.53.84.53.84.53.84.53.84.53.84.53.84.53.84.53.84.53.84.53.84.53.84.53.84.53.84.53.84.53.84.53.84.53.84.53.84.53.84.53.84.53.84.53.84.53.84.53.84.53.84.53.84.53.84.53.84.53.84.53.84.53.84.53.84.53.84.53.84.53.84.53.84.53.84.53.84.53.84.53.84.53.84.53.84.53.84.53.84.53.84.53.84.53.84.53.84.53.84.53.84.53.84.53.84.53.84.54.54.54.54.54.54.54.54.54.54.54.54.54	1 30,515 120 NW. 0 0 0 1 1 5 12 40 35 6 5,49 1.88 16 4 22,615 108 SE. 8 4 1 5 3 8 26 27 2 1,87 6,78 18 6 25,005 128 NW. 3 0 0 1 4 16 36 31 2 0.95 6,76 71 18 8 25,670 90 NW. 8 7 1 6 5 8 17 38 0 2,600 44 10 5 18,000 98 NW. 7 6 5 6 17 10 15 26 1 2,29 0.76 13 5 25,025 100 W. 5 2 1 0 7 4 25 45 11 15,36,2 96 8 7 20,500 96 W. 2 4 1 2 7 13 25 38 111,342 00 10 6 18,760 92 S. 4 2 2 6 6 11 28 33 114,204,61 8 4 21,265 90 NW. 7 3 1 1 2 10 45 21 0 5,561,461 18 7 20,965 94 SE.	$\begin{array}{cccccccccccccccccccccccccccccccccccc$

59 47 23 56 64 131 319 384

2 10 45 21 5 19 32 13 2 9 14 31 1 11 16 50

2.03.03.83.0 18.760 92 8. 1.04.11.52.4 21.265 90 NW. 2.04.83.03.7 20.965 94 SE. 3.45.03.94.1 23.100 95 NW. 2.74.25.74.2 30.010 96 NW.

3.04.33.23.5 287, 870

MYER, FORT, VA. [Latitude, 28° 53' N.; longitude 77° 0' W. Local time, 0.08 slow, Eastern.]

	Pre	esure.				T	empe	ratu	re.			נ	Dow 1	oint			Rola Imie		
Year.										Me	AD.								
Months and year	Mean.	Maximum.	Minimum.	7 a. m.	3р. m.	11 р. ш.	Mean.	Maximum.	Minimum.	Maximum.	Minimum.	7 a.m.	8 p. m.	11 p.m.	Moen.	7 a. m	8 p. m.	11 9.15	Mosp.
J F M J J S O N	In. 29. 868 29. 787 29. 795 29. 790 29. 770 29. 713 29. 721 29. 819 29. 749 29. 749 29. 764	In. 30, 56 30, 22 30, 20 30, 41 29, 93 30, 04 29, 92 29, 98 30, 11 30, 10 30, 11 30, 51	29, 29 28, 90 29, 35 29, 08	28. 5 21. 8 28. 6 44. 9 57. 0 64. 6 73. 2 67. 1 58. 5 49. 2 40. 3 81. 9	o 85, 2 29, 8 38, 9 61, 3 67, 6 79, 0 85, 7 79, 7 60, 9 49, 8 41, 4 58, 6	0 30, 7 24, 1 31, 9 50, 3 59, 0 67, 5 75, 8 69, 8 63, 4 52, 9 43, 2 35, 9 50, 4	81. 5 25. 1 33. 1 52. 2 61. 2 70. 4 78. 2 65. 2 54. 3 44. 4 52. 0	95 98 94 90 76 72 63	1 8 29 40 50 63 49 43 85 20 12	0 42. 8 83. 2 42. 4 63. 8 70. 6 81. 4 88. 8 75. 2 63. 5 51. 2 44. 7 61. 5	22. 9 17. 6 24. 7 42. 1 52. 7 59. 4 69. 2 64. 0 56. 0 46. 1 37. 3 29. 0 43. 4	22. 9 17. 6 21. 9 38. 2 51. 6 57. 9 67. 1 63. 2 54. 5 45. 8 35. 6 24. 5	25. 1 20. 3 25. 5 39. 4 52. 2 58. 1 66. 5 63. 5 57. 2 47. 4 87. 2 28. 5 43. 4	35.8	19. 8 23. 5 39. 3 51. 8 58. 1 67. 1 63. 2 56. 3 46. 9	85 77 78 83 79 82 86 87 89 84 75	69 68 62 47 62 50 55 58 63 65 62 60	79 84 70 79 78 76 80 80 82 71 77	76 79 70 65 75 71 73 75 76 70 73
		[Latit	tude, 3	60 10'	N. ; 1					TEN.	N. cal tir	ne, 0.	47 alo	w, E	atern	.]			_
J M M J S O D	29. 595 29. 457 29. 533 29. 452 29. 374 29. 470 29. 445 29. 454 29. 421 29. 446 29. 562 29. 468	30. 07 29. 86 29. 93 29. 79 29. 60 29. 65 29. 67 29. 67 29. 69 29. 70 30. 07	29. 22 29. 05 28. 92 29. 24 29. 24 29. 15 29. 21 29. 01 28. 96	28. 3 28. 1 35. 2 51. 9 59. 1 70. 6 73. 1 71. 5 64. 7 49. 1 42. 8 85. 7 50. 8	39. 0 40. 4 50. 2 66. 4 72. 5 82. 4 86. 1 85. 8 77. 9 64. 6 55. 5 46. 3	32. 1 31. 6 40. 0 58. 3 64. 3 73. 2 76. 1 74. 7 68. 4 53. 3 47. 4 39. 0 54. 9	41.8	70 74 82 83 92 96 96 88 78 72	-2 -1 17 34 42 60 58 56 46 83 30 18 -2	43. 3 43. 2 53. 5 69. 8 75. 1 84. 3 88. 1 87. 4 80. 0 66. 4 57. 8 49. 0 66. 5	24. 1 23. 0 32. 4 49. 9 57. 0 68. 2 71. 0 69. 6 47. 0 41. 0 32. 1 48. 2	23. 2 23. 6 29. 9 44. 0 54. 4 64. 7 68. 7 68. 1 59. 8 46. 1 34. 2 30. 2 45. 7	28. 9 34. 5 47. 8 54. 8	24. 8 81. 0 47. 7 55. 8 66. 2 70. 2 65. 7 60. 5 47. 8 89. 2	25. 8 31. 8 46. 5 55. 0 65. 8 69. 5 66. 2	83 81 75 85 82 86 83 84 89	67 65 57 58 59 59 54 61 60 58	78 76 71 69 75 79 82 74 77 82 74 73	75 75 70 68 72 73 76 70 74 77 72 71 73
	-	[Lati	tude, 4	10 18	N.;	longi	NEV	7 H 72•	A V I	EN, C	CONN. ocal ti	me, 0.	08 fa	st, Es	ustern	.]		-	
J F M J J S O D Y	29. 963 29. 852 29. 911 29. 873 29. 873 29. 856 29. 869 29. 941 29. 810 29. 869 29. 888	80. 70 30. 34 80. 38 30. 45 80. 19 80. 17 30. 12 30. 28 30. 20 30. 21 30. 60 80. 70	29. 14 28. 97 29. 39 20. 23 29. 48 29. 85 29. 60 29. 55 29. 24 29. 18 29. 42 29. 03	24. 8 15. 9 22. 5 41. 9 52. 8 62. 0 68. 8 64. 1 55. 4 47. 0 38. 6 80. 7 43. 6	30, 2	25. 9 18. 9 25. 7 43. 0 52. 1 61. 4 69. 1 65. 1 58. 1	26. 8 19. 7 26. 9 46. 0 54. 9 65. 2 72. 1 67. 8 60. 7 51. 6	54 51 53 83 82 89 93 86 83 76	-1 -2 zero 23 31	85. 1 29. 0 86. 0 56. 1 75. 8 81. 3 76. 8 72. 0 60. 9 49. 5 41. 5 56. 5	18. 5 12. 2 18. 4 36. 5 46. 2 55. 0 63. 4 60. 4 51. 0 43. 0 35. 6	19. 0 11. 6 17. 1 83. 0 43. 8 54. 4 62. 1 59. 5 50. 8 43. 2 83. 6 24. 2 87. 7	20, 5 15, 8 19, 9	20. 1 13. 8 20. 0 84. 4 44. 2	19. 9 13. 7 19. 0 33. 6 43. 7 53. 2 62. 2 60. 0 52. 8 44. 4	80 83 80 73 74 77 81 85 85 87	68 70 60 49 57 53 56 63 58 67 59	79 80 79 74 76 73 82 86 85 87 79	75 78 73 66 68 73 76 78 76 69 73
		[Lat	itude,	410 2	ľ N.;					, CO 7. L	NN. ocal ti	me, 0.	12 fa	st, Es	stern	.)			_
J F M J S O N P	80. 040 29. 920 29. 987 29. 952 29. 952 29. 949 29. 950 80. 020 80. 000 29. 895 29. 944 29. 964	30. 78 30. 39 30. 48 30. 52 30. 27 30. 20 30. 23 30. 37 30. 30 30. 31 30. 69 30, 78	29. 00 29. 47 29. 25 29. 51 29. 65 29. 65 29. 28 29. 24 29. 48 29. 12	26. 9 18. 9 25. 8 44. 6 53. 8 64. 5 69. 9 66. 2 57. 5 49. 5 41. 9 32. 3 46. 0	32. 0 27. 5 34. 4 51. 8 57. 7 70. 6 75. 9 66. 6 58. 6 48. 7 38. 4 52. 9	21. 8 28. 8 44. 8 52. 0 61. 2 68. 4 66. 1 58. 8 50. 7 43. 6 34. 2	29. 0 22. 7 29. 7 47. 0 54. 5 65. 4 71. 4 61. 0 52. 9 44. 7 35. 0 48. 5	44 53 78 80 83 92 85 79 75 66 59	1 2 6 26 35 46 53 49 39 35 22 14	36. 6 30. 5 36. 9 55. 7 62. 0 73. 6 79. 5 75. 4 69. 5 51. 5 42. 0 56. 2	21. 0 14. 9 21. 5 3R. 1 47. 1 56. 6 64. 4 61. 9 52. 2 45. 3 3R. 9 27. 9	21. 6 12. 1 19. 3 34. 5 44. 3 55. £ 63. 4 62. 0 51. 9 45. 0 35. 5 25. 7 39. 3	43. 9 55. 4 64. 3 65. 4 55. 8 48. 5 36. 5 28. 4	35. 4 44. 5 53. 8 63. 9	14. 8 20. 4 85. 2 44. 2 55. 0 63. 9 63. 1 53. 8 46. 4 86. 0	75 77 69 72 75 80 87 82 85 78	58 63 61 69 76 69 70 69	71 72 73 77 77 77 86 87 79 82 75 77	74 70 60 71 71 78 84 76 79 72 74

MYER, FORT, VA.

											(H	=2	67.	A:	=1.	}											
			oss. hs).					•	Wir	ıd.							Prec tati	ipi- on.		N	ımb	er (	of	day	8	-	
7 a. m.	SP.B.	11 p. m.	Meen	- Trough	Total (miles).	Maximum.	Direction.	North.	Northeast.	East.	Southeast	South.	Southwest	West	Northwest	Calms.	Total	Max. 24 hours.	Clear.	Fair.	Cloudy.	Rain or snow.	Max. below 32°.	Min. below 820.	Max. above 90°.	Thunder-storms.	Months and year.
4.0 6.2 3.4 4.5 4.5 4.6 6.1	4.547.4555564	8 5.4. 9 5.1. 9 5.1. 7 4. 5 5.5. 7 3. 7 3. 7 3. 7 3. 7 3. 7 3. 7 3. 7 3	425.5.4.6.3.4.4.4.4.4.4.4.4.4.4.4.4.4.4.4.4.4	32242374725	5, 488 8, 909 7, 087 6, 538 4, 478 3, 454 5, 313 6, 580 8, 256 9, 078	37 50 27 37 26 49 42 41 36		2 9 8 9 12 4 3 8 6 7 16 91		5 12 5 12 28 2 5 4 8 8 1 4	8	15 3 13 19 10 17 10 20 16 15 11 5	11 13 10 6 12 13 17 12 12 18 19	10 5 14 7 7 5 6 9 5 5 9 11 93	32 34 26 18 19 14 8 21 19 27 39 23 280	7 5 1 0 0 2 1 8 3 1 26	In. 3. 92 4. 21 1. 47 1. 33 2. 51 1. 14 2. 88 7. 29 2. 60 9. 72 3. 40 2. 57 42, 54	0. 45 1. 25 0. 86 0. 68 2. 55 1. 09 3. 21 1. 18 1. 14	8 8 5 10 5 10 5 11 11 8 8 93	15 9 21 16 13 10 14 15 12 13 16 20	8 11 5 4 13 0 2 7 7 7 11 8 78	11 12 8 9 12 5 7 10 5 12 10 6	0	25 27 23 4 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	1 4 3 5 2 1 0	0 J. 0 F. 0 M. 0 J. 0 J. 0 S. 0 O. 0 D.
-	<u> </u>	<u>'</u>									18E H =		LL. 9.	E, :			•	<u>'</u>						'		!-	<u>-</u>
6. 3 6. 3 6. 2 5. 2 6. 9 4. 4 4. 9 5. 9 5. 7 5. 8	5.66655656	8 1. 9 4. 3 5. 3 1. 4. 6 4. 9 5. 7 4.	05. 15. 95. 14. 54. 55. 45. 45.	3 4 9 1 8 7 8 8 9 7 6	5, 149 4, 901 5, 562 4, 224 3, 763 3, 111 4, 049 4, 051 5, 022	32 29 28 30 30 33 37 33 28 28 36	W. NW. NW. S. W. NW. NW. NW. NW. NW.	7 7 7 15 5 2 10 5 8 9 7 2 2 2 79	6 4 13 8 7 14 6 3 7	6 8 11 21 13 10 6 29 17	9 6 10 8 8 9 12 7 13 13	11 20 18 12 13 2 5 10 16 16	8 16 24 8 8	9 19 13 19 22 11 16	23 19 18 19 13 13 12 7 16 24	000000000000000000000000000000000000000	2. 00 2. 33 3. 75 4. 36 3. 72 5. 26 1. 02 5. 60 2. 99 2. 73	0. 86 0. 79 2. 25 0. 63 3. 01 1. 42 1. 00 1. 13	5 4 6 6 7 5 6 5 6 10 10 5 75	14 18 17 15 15 17 22 20 13 12 6 20 189	12 6 8 9 8 8 8 3 6 11 9 14 6 100	13 9 10 10 12 12 8 5 8 9 9 7	8 7 0 0 0 0 0 0 0 0 0 1 16		5 1 15 1 10 0 0 0	1 2 5 11 19 5 3 1 2 2	0 J. 0 F. 1 M. 0 A. 0 J. 0 J. 0 S. 0 O. 0 N. 0 D.
-		1	-					1			W H =		V E	N, h=			Γ.									1	-!
4.5 2.6 4.4 4.5 2.7 4.5 4.5 4.5 6.3	表示在了 本本在立在成代	0 3.4.3 3.3 1.2.6 8 1.3.5 6.4 5.5 6.	14 03 44 73 95 83 13 64 32 26 64	844886302	6, 837	50 28 3 35 5 29 5 29 7 22 5 32 2 24 5 30 7 32 0 31	N. E. NW. NE. W. E. N. NE. E. N. NE. E. W. NE. W. NE. W. NE. E. W. NE. E. W. NE. E. W.	25 21 22 20 15 10 9 25 16 16 23 17 219	17 3 6 20 2 6 7 9 15	13 0 1 3 2 5 2 0	2 4 11 1 8 8 4 5 1	12 27 29 21 12 15 10	11 9 20	16 15 16 11 3 12 6 6 6 11 8 25 20 149	16 16 9 5 12 10 11 8 13 3 17	15 7 10 6 11 5 11 5 4	3, 15 1, 19 2, 31 2, 61 1, 43 2, 51 8, 13 0, 77 5, 37 3, 49	0, 93 0, 59 1, 46 4, 51 0, 58 2, 24 1, 45 1, 10	15 7 15 11 11 18 14 6	13 14 17 11 16 14 18 13 11 8 13 15 163	7 3 4 4 8 1 2 7 1 9 11 12 69	12 12 9 9 11 7 6 14 5 9 11 10 115	00000004	26 25 29 8 1 0 0 0 0 1 12 28 133	000003000003	0 0 0 2 3 6 0 1	1 J. 0 F. 1 M. 0 A. 1 M. 0 J. 1 J. 1 J. 0 S. 0 O. 0 D. 4 Y.
									-	NE.			VD(		C0 = 58		₹.										
1172733854 112521854	4. 1 4. 1 5. 1 5. 1 5. 1 5. 1 5. 1 5. 1	23.3.4.2.2.4.1.2.4.5.	93.4 93.4 93.5 13.5 13.5 42.3 5.5 2.5 5.5 5.5	60138085832	6, 702 4, 832 4, 085 4, 518	48 28 29 32 23 23 27 23 31 52 45	E. NW. NW. SE. S. SW. E. S. S. SE.		8 5 9 21 8 3 2 2	8 2 9 0 1 4 2 7 3	0 19 7 5 7 1	9 12 22 16 18 12 1	5 19 13 25 17 20 16 15	26 14 14 8 21 6 7 6 11 21 19	18 26 10 5 13 11 6 45 11 13 25	9 8 7 16 13 9 3 8	4. 03 1. 55 3. 34 5. 02 2. 12 2. 67 7. 69 1. 44	0. 68 1. 24 1. 30 1. 04 1. 49 3. 71 1. 23 2. 51 1. 82 1. 37	16 10 18 15 9 19 15 10 9	9 11 10 13 15 10 8 11 12	5 10 2 3 7 1 8 9	12 13	16 9 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	24 28 26 5 0 0 0 0 0 6 23 112	0 0 0	0 0 3 0 2 1 2 0 0 0	0 J. 0 F. 0 M. 0 A. 0 J. 0 J. 0 S. 0 O. 0 N. 0 D.

Pressure.

46.0 47.1 98

## Monthly and yearly meteorological summaries-Continued.

## NEW ORLEANS, LA.

Relative

bumidity.

52.6 37.6 34.8 26.2 38.7

Dew point.

[Latitude, 29° 58' N.; longitude, 90° 4' W. Local time, 1.00 slow, Eastern.]

Temperature.

اند																. =			-1
year										Мe	an.								
Months and	Мевл.	Maximum.	Minimum.	7 a. m.	3 p. m.	11 р. т.	Mean.	Maximum.	Minimum.	Maximum.	Minimum.	7 a. m.	8 p. m.	11 р. ш.	Mean.	7 a. m.	3 p. m.	11 p. m.	Mean.
J F M J S O D Y	In. 30. 113 80. 008 80. 089 29. 978 29. 893 29. 994 29. 901 29. 936 29. 901 29. 967 30. 025 30. 148 80. 004	In. 30. 53 30. 36 30. 49 30. 25 80. 06 30. 13 80. 16 80. 11 80. 05 80. 27 80. 30 30. 47	In. 29, 74 29, 55 29, 70 29, 77 20, 60 29, 79 29, 87 29, 70 29, 72 29, 72 29, 58 29, 55	0 48. 4 48. 5 53. 3 66. 1 78. 8 79. 6 74. 3 60. 3 55. 3 48. 3 63. 4	0 56. 0 58. 4 63. 6 75. 5 78. 2 86. 4 87. 4 81. 5 72. 7 65. 6 59. 0 72. 4	51. 8 52. 5 58. 2 69. 8 73. 4 81. 7 79. 1 75. 5 64. 2 58. 1 52. 1 66. 5	52. 1 53. 1 58. 4 70. 5 73. 9 82. 9 82. 9 80. 4 77. 1 65. 7 59. 7 53. 1 67. 4	92 92 92 92 80 85 73 93	28 30 36 52 60 72 74 70 66 49 40 30 28	58. 6 60. 8 65. 6 76. 4 80. 3 89. 1 90. 2 89. 2 89. 2 73. 7 67. 0 61. 6 74. 9	51. 1 64. 9 68. 4 76. 8 76. 8 74. 7 72. 1 58. 2 52. 2 45. 0	9 41, 5 40, 9 45, 6 60, 7 64, 2 72, 8 74, 0 75, 0 56, 1 56, 1 56, 5	43. 0 40. 6 46. 4 61. 0 62. 3 69. 5 71. 8 73. 4 72. 7 54. 3 50. 5 47. 6 57. 8	0 42. 9 42. 3 48. 6 62. 6 64. 9 73. 0 74. 1 75. 2 72. 2 58. 6 51. 5 46. 1 59. 3	46. 9 61. 4 63. 8 71. 8 73. 3 74. 5 72. 3 56. 3 50. 8	76 76 84 82 83 92 83 86 85	65 54 57 62 60 59 61 71 76 54 61 67 62	72 69 71 78 76 76 78 88 90 82 81 81	72 66 68 75 72 74 84 86 74 75 78
		[Lat	itude,	400 43			YO:					e, 0. <b>04</b>	fast,	Easte	rn.]	•			
J F M J J S O V	29. 917 29. 798 29. 869 29. 859 29. 813 29. 832 29. 808 29. 819 29. 900 29. 853 29. 765 29. 831 29. 839	80. 65 30. 30 80, 81 30. 44 80, 11 30, 12 80, 04 30, 11 80, 23 30, 13 30, 17 30, 55 30, 65	29. 13 28. 90 29. 36 29. 29 20. 44 29. 28 29. 55 29. 53 29. 18 29. 03 20. 40 29. 02 28. 90	27. 7 20. 0 25. 6 43. 0 52. 8 63. 0 70. 5 67. 6 59. 9 51. 2 41. 5 33. 5 46. 4	31. 9 27. 0 34. 9 54. 4 61. 6 74. 5 80. 0 76. 0 70. 1 59. 3 49. 1 39. 1 54. 8	28. 0 22. 4 28. 5 45. 8 54. 5 64. 5 62. 3 53. 0 43. 7 35. 3 48. 2	29. 2 23. 1 29. 7 47. 7 56. 2 67. 3 74. 2 70. 8 64. 1 54. 5 44. 8 36. 0 49. 8	60 51 58 81 85 91 96 84 74 69 60	50 66 27 39 51 56 51 43 34 25 14	37. 6 31. 3 37. 9 58. 3 64. 7 78. 0 83. 5 78. 8 73. 4 62. 7 52. 5 44. 4 58. 6	22. 2 16. 1 22. 5 39. 7 48. 8 59. 0 67. 4 64. 2 57. 1 47. 9 39. 2 29. 4 42. 8	23. 3 14. 4 19. 5 85. 0 45. 3 .55. 9 63. 7 62. 1 53. 0 46. 4 35. 2 25. 1 39. 9	26. 5 19. 4 23. 8 38. 3 48. 0 57. 1 64. 5 61. 7 53. 1 45. 7 27. 6 41. 8	23. 5 17. 8 22. 7 36. 7 47. 7 55. 2 63. 2 54. 7 47. 1 35. 6 26. 7 41. 4	24. 4 17. 2 22. 0 36. 7 47. 0 56. 1 64. 6 62. 3 53. 6 46. 4 35. 5 26. 5	77 74 77 78 80 83 78 84	80 73 64 57 65 61 63 63 62 64 64	83 79 72 80 72 81 83 77 81 74 71	82 78 73 68 74 69 74 76 70 76 71 69 73
		Latitu	.de. 36	51' 7	V.: lo	noitn	NOR		•		al tin	10, 0.03	slow	. Eas	tern. l				
J F M J J S O V	30. 148 29. 993 30. 061 30. 020 29. 906 30. 006 29. 957 30. 044 29. 953 29. 953 30. 028 30. 028	30. 75 30. 47 30. 48 30. 53 30. 15 30. 25 30. 17 30. 19 30. 31 80. 32 30. 67 30. 75	29. 56 29. 26 29. 62 29. 60 20. 52 20. 63 29. 71 29. 65 29. 55 29. 23 29. 54 29. 32 29. 23	40. 2 33. 9 35. 7 52. 5 62. 0 71. 5 76. 7 75. 0 66. 2 56. 7 47. 1 39. 2 54. 7	46. 2 41. 7 47. 2 64. 2 70. 6 80. 6 87. 8 83. 2 76. 0 65. 6 57. 2 48. 8 64. 1	41. 8 36. 1 39. 6 54. 6 62. 8 70. 7 77. 0 75. 6 67. 8 49. 8 41. 7 56. 4	42. 7 37. 2 40. 8 57. 1 65. 1 74. 3 80. 5 77. 9 70. 0 60. 4 51. 4 43. 2 58. 4	71 66 69 81 84 97 99 82 78 69 99	20 14 20 35 47 56 69 60 51 43 35 22 14	50. 5 44. 9 49. 5 66. 2 73. 0 83. 2 90. 5 85. 4 77. 7 67. 9 58. 9 52. 1 66. 6	34. 4 29. 8 33. 5 47. 9 58. 3 65. 8 72. 5 71. 3 63. 0 53. 5 44. 5 34. 3 50. 7	34. 5 27. 7 30. 0 45. 3 57. 7 64. 3 69. 2 68. 4 60. 6 52. 2 52. 0 33. 2 48. 8	34. 5 29. 4 33. 4 48. 0 58. 7 63. 7 68. 2 64. 6 59. 3 53. 2 44. 3 33. 9 49. 4	34. 5 29. 7 32. 4 45. 5 57. 8 64. 4 70. 4 68. 4 62. 1 52. 3 43. 6 32. 3 49. 4	34. 5 28. 9 31. 9 46. 3 58. 1 69. 3 67. 8 60. 7 52. 6 43. 0 33. 1 49. 2	80	65 63 60 58 58 54 59 57 66 61 60 61	76 77 76 72 84 81 79 82 79 80 70 78	74 73 72 69 79 71 73 74 77 75 70 73
		(Latit	ade, 41	0 8/ N	ſ.; lo:						EBR. cal tir	ne, 1.4	3 alov	v, Ea	stern.	1			
J F M J J S O N YA.	27, 105 27, 035 27, 154 26, 909 27, 088 27, 088 27, 091 27, 118 27, 073 27, 115 27, 020 27, 091 27, 077	27, 53 27, 36 27, 40 27, 37 27, 33 27, 38 27, 35 27, 44 27, 35 27, 44 27, 35 27, 47, 27, 53	26, 54 26, 55 26, 83 26, 42 26, 67 26, 66 26, 50 26, 50 26	7. 4 15. 2 28. 6 43. 7 49. 1 58. 4 64. 1 53. 3 88. 4 31. 9 26. 9 39. 8	19. 8 26. 3 46. 4 59. 8 63. 9 73. 6 80. 9 75. 4 71. 6 50. 2 47. 5 40. 8 55. 4	11, 5 17, 8 34, 9 50, 5 55, 8 65, 2 71, 7 65, 4 61, 6 47, 4 47, 6 31, 0 46, 0	12. 9 19. 8 36. 6 51. 3 56. 3 65. 7 72. 2 67. 2 48. 3 30. 5 32. 9 47. 1	47 50 69 75 85 89 98 8: 00 83 69 98	-27 -22 10 30 28 44 48 51 43 19 23 -6 -27	23, 5 29, 9 49, 4 63, 0 66, 7 78, 0 81, 8 78, 3 74, 2 61, 1 50, 8 44, 3 58, 8	2, 3 10, 4 26, 6 40, 9 47, 2 55, 8 62, 2 51, 7 36, 2 30, 7 24, 2 37, 3	1. 0 9. 0 22. 7 36. 4 44. 5 53. 0 60. 8 56. 1 49. 2 33. 9 22. 9 22. 9 35. 1	12. 2 18. 4 30. 2 39. 1 44. 6 55. 3 64. 3 53. 8 37. 8 36. 1 30. 8 40. 0	5.4 12.0 27.4 40.4 47.1 57.8 63.8 63.6 37.6 34.8 26.2 38.7	6. 2 13. 3 26. 8 38. 6 45. 4 55. 6 63. 0 50. 2 51. 0 32. 6 37. 0	78 76 84 85	72 72 56 49 50 60 60 60 52 49 67 69 59	787740777722750750877	はおきのいればいいをおけれ

-27 58, 8

NEW ORLEANS, LA.

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		dine nth					•	Wir	d.							Prec tati	ipi- on.		Nu	mt	er	of ·	day	8	•		
7 t. m.	8 p. m.	11 p. m.	Moan.	Total (miles).	Maximum.	Direction.	North.	Northeast.	East.	Southeast.	South.	Southwest.	West.	Northwest.	Calms.	Total.	Max. 24 hours.	Clear.	Fair.	Cloudy.	Rain or snow.	Max. below 32º.	Min. below 32°.	Max. above 90°.	Thunder-storms.	Auroras.	Months and year.
5.3 4.6 5.6 3.9 5.7 2.5 5.7 2.5 4.5 4.5	6.5 5.5 5.5 5.5 6.7 8.8 8.2 4.2 4.2	4.5	5. 4. 8 4. 9 5. 7 3. 8 4. 7 5. 2 3. 7 4. 4	6, 644 5, 801 5, 155 4, 538 3, 467 3, 517 3, 914 4, 805 5, 247 5, 061 5, 813 59, 504	28 21 24 26 28 23 24	NW. NW. SW. SE. SE. SE. N. NW. N., S. SE.	14 21 19 7 6 10 4 6 8 20 25 19	7 10	159	7 7 8 27 31 20 33 11 14 7 17 16 198	9 10 8 12 4 11 8 4 5 6 8 2 87	12 10 11 5 10 19 15 21 2 4 7 9 125	3 4 1 3 7 7 7 9 14 5 6 71	8 9 5 6 7 4 9 10 13 12 13 105	1	In. 9, 70 2, 89 6, 99 3, 67 5, 77 3, 30 6, 15 4, 25 13, 55 0, 56 3, 47 4, 88 64, 18	1. 38 1. 98 1. 05 3. 23 0. 40 1. 35 3. 40	10 8 6 4 16 13 17	13 17 17 20 23 22 16 12 12	8 6 7 0 3 10 8 5 7	15 9 10 15 12 20 18 17 3 6 8 142	0000	8 1 0 0 0 0 0 0 0 0 0 1 5	0 0 0 0 0 11 17 16 5 0 0 49	4 1 2 8 7 14 9 8 0 1 1 56	00000000000	J. F. M. A. M. J. A. 8. O. N. D. Y.
	<b>.</b>	•	<u></u>		··			N		Y(		K (		Y,		Y.									<u> </u>		_
4.66 4.61 4.35 4.35 4.31 4.35 4.31 4.35	4.0 4.4 6.7 6.8 6.2 7.6 8	4. 0 3. 4 5. 0 3. 1 2. 8 4. 4 2. 3 3. 1 4. 9	4.4 4.8 3.6 3.8 4.7 4.3 5.6 6.8	8, 886 6, 838 7, 342 7, 048 5, 224 5, 108 4, 127 6, 885	50 41 48 46 32 37 34 32 37 44 40 50	W. NW.W. NE. NW. N. SE., S. NW. SE., S. NW. W.	4 7 15 9 7 2 8 8 5 6 9 10 95	8 4 11 12 11	2 5 2 2 16 1 3 7 4 6 0 1 49	3 2 4 9 16 8 14 11 4 11 5 4 91	24 16	23 4 6 7 6 16 14 11 13 11 10 10 131	35 15 14 15 4 11 10 12 12 13 10 21 172	17 29 27	12 17 3 6 2	6, 09 1, 19 2, 44 2, 22 1, 86 3, 04 7, 70 0, 72 5, 62 5, 05	1. 21 2. 62 0. 43 0. 92 0. 74 0. 69 1. 06 2. 87 0. 25 1. 59 1. 65 1. 32 2. 87	7 12 11 10 17 12 6 7	13 16 8 12 15 18 14 12 12 15 21	6 7 12 3 2 7 1 9 3	10 12 10 9 11 7 7 9 9 9 11 7	16 9 0 0 0 0 0 0 0 0	24 28 25 4 0 0 0 0 0 0 0 3 19 103	0 0 0 0 0 0 1 7 0 0 0 0 0 0 0 0 0 0 0 0	0 0 0 1 0 4 4 7 0 2 0 0 1 8	000000000000000000000000000000000000000	J. F. M. A. M. J. J. A. S. O. N. D. Y.
										NO		OL.		VA 52.						12.1				-1	-1	_	_
4.6.2200523	5, 5 5, 1 7, 1 8, 5 4, 5 5, 6 4, 8 6, 8	6. 1 5. 8 1. 7 2. 4 2. 6 4. 8	5. 7 5. 1 4. 2 6. 5 4. 5 4. 5 4. 5 4. 7	6, 976 5, 579 6, 589 5, 864 4, 355 5, 024 4, 527 5, 250 4, 830 5, 133 6, 065 65, 586	26 26 18 24 19 20 25 30	W. W. NE. NW. N. SW. N. SW. NE. E. N.	15 28 20 10 17 10 6 8 10 20 22 29 195	14 9 15 17 16 11 9 16 36 20 11 5	4 6 7 15	2 8 6 9 10 15 12 16 6 12 3 4	14 7 9 10 6 8 10 13 11 5 24 10	18 8 19 13 13 22 30 19 14 11 5 15 187	18 13 6 7 4 5 9 5 3 6 10 17	8 10 11 9 12 6 10 3 2 9 14 6 100	0 0 0 0 0 0 1 2 1 3 0 5	3, 79 3, 04 1, 92 6, 16 3, 48 3, 22 2, 39 3, 31 3, 33 4, 64	1.43	7 12 5 10 14 10 11 12 10 15	8 14 11 13 14 17 15 14 12 11	10 10 7 13 7 8 4 4 5 8 5	14 14 14 11 20 8 13 10 4 10 14 9	1000000	10 16 11 0 0 0 0 0 0 0 0 11 48	0 0 0 0 5 16 11 0 0 0 32	1 0 1 2 6 3 5 0 2 2 0 0 2 2	000000000000000000000000000000000000000	J. F. M. A. M. J. J. A. S. O. N. D. Y.
								N		ГН 7—		LA?		E, 1 = 34		BR.											
3.9 5.0 4.2 5.1 4.9 6.3 6.3 4.4 2.4 2.0			4. 0 4. 4 3. 5 4. 8 5. 2 4. 9 4. 1 4. 2		32 48 40	NW. SW. NW. S. SE. SE. NW. NW. NW. NW.	10 8 16 11 10 7 12 11 15 5	7 2 2 6 4 7 6 2 2 2	11 10 23 31 19	17 26 19 17 8 16	5 13 14 12 11 20 19 7	8 4 9 0 3 2 1 2 5 6 5 10 55	34 29 23 6 6 7 2 3 5 14 28 27 184	16 10 10 12 20 8 7 10 6 21 19 22 107	8 17 11 12 3 13 10 2 2 0 4	0, 16 0, 37 1, 59 3, 31 3, 79 3, 12 4, 87 0, 86 1, 18 1, 71 0, 95	1, 05 1, 56 0, 36 0, 57 1, 05	11 15 6 6 7 4 8 16 15 18	12 12 18 19 15 22 16 8 14 8	54668576257	5 6 7 10 12 14 12 19 7 7 9 5 14	300000000	31 25 26 2 2 0 0 0 6 19 23	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	000186540000	000000000000000000000000000000000000000	J. F. M. A. M. J. A. S. O. N. D. V

## OLYMPIA, WASH.

[Latitude, 47° 3' N.; longitude, 122° 53' W. Local time, 3.11 slow, Eastern.]

	Pr	essure				Te	mper	itur	o.			1	Dew p	oint.			tela umi		
year.										Me	an.								đ
Months and	Mean.	Maximum.	Minimum.	7 a.m.	3 p.m.	Пр. ш.	Mean.	Maximum.	Minmium.	Maximum.	Minimum.	7 a. m.	3 p. m.	11 р. ш.	Mean.	7 8, 10.	3 p. m.	Пр. т.	Mean.
	In. 30, 071 30, 024 30, 154 30, 024 29, 927 29, 978 29, 976 29, 982 29, 757 30, 014 29, 983	In. 30, 44 30, 54 30, 27 30, 18 30, 36 30, 25 30, 21 30, 17 30, 24 30, 21 30, 48 30, 54	29, 65	37, 9 42, 8 39, 8 46, 4 53, 5 53, 7 51, 8 52, 6 44, 6 40, 6 45, 6	5 42. 4 47. 8 51. 9 56. 0 62. 2 66. 4 71. 3 67. 6 62. 5 57. 4 48. 1 45. 6 56. 6	69, 5	40. 0 45. 1 47. 1 49. 0 55. 5 61. 1 64. 9 57. 9 51. 0 45. 8 43. 0 51. 8	59 64	28, 30, 30, 36, 37, 43, 44, 43, 34, 31, 23, 23,	9 46. 7 51. 2 59. 3 63. 2 68. 7 72. 0 78. 6 75. 6 68. 2 62. 4 51. 0 48. 8 62. 1	35. 5 39. 9 37. 7 36. 3 44. 3 49. 5 50. 6 49. 1 49. 8 49. 9 37. 7 42. 6	35, 3 40, 5 38, 1 36, 6 43, 6 48, 6 50, 2 49, 5 50, 7 42, 8 41, 8 38, 8 43, 0	0 87. 7 42. 4 43. 2 43. 9 48. 8 54. 0 56. 7 55. 3 48. 4 44. 1 41. 8 47. 7	50. 4 42. 2 44. 2 42. 1 47. 0 50. 4 56. 2 54. 8 48. 0 43. 1 40. 2 46. 8	46.4 43.0 40.3	90 85 88 92 93 93 93	74 65 63 66 60 69 78 73 87	64 78 88 90 93 91	86 80 70 74 71 71 81 87 80 91

## OMAHA, NEBR.

[Latitude, 41° 16' N; longitude, 95° 56' W. Local time, 1.24 slow, Eastern.]

J M J S O D Y	28. 975 24. 881 28. 938 28. 803 28. 788 28. 836 28. 849 28. 849 28. 822 28. 912 28. 860	29. 29 29. 28 29. 17 29. 12 29. 14 29. 06 29. 15 29. 20 29. 19 29. 17 29. 35	28. 39 28. 57 28. 44 28. 46 28. 41 28. 49 28. 55 28. 37 28. 57	11. 8 29. 5 43. 9 53. 0 65. 4 71. 1 63. 8 57. 8 42. 6 35. 2 24. 0	21. 4 42. 7 55. 8 66. 5 77. 7 84. 0 76. 6 71. 8 57. 6 45. 7 33. 4	16. 7 36. 1 50. 7 59. 9 70. 3 75. 8 69. 3 64. 0 49. 2 38. 9 28. 3	16. 6 36. 1 50. 1 59, 8 71. 1 77. 0 69. 9 64. 5 49. 8 39, 9	-18 66 977 28 86 29 94 49 98 55 91 50 89 45 75 80 33 21 30 -4	46. 6 59. 9 69. 9 81. 9 87. 2 79. 1 74. 0 60. 6 48. 3 37. 3	8. 9 27. 3 42. 1 50. 8 62. 7 68. 3 61. 8 56. 8 41. 0 32. 2	6. 5 24. 1 38. 5 47. 7 60. 5 66. 0 60. 1 53. 8 38. 6 32. 3 20. 5	41. 1 46. 8 61. 1 68. 2 63. 0 55. 2 39. 8 34. 8 25. 8	11. 8 28. 6 42. 8 49. 2 62. 2 68. 7 63. 9 57. 6 41. 4 34. 7 23. 3	9. 8 26. 1 40. 8 47. 9 61. 3 67. 6 62. 3 55. 5	79 80 82 81 84 88 87 86 89 86	64 52 60 51 57 60 63 58 53	74 75 69 76 79	67247X 757381

## OSWEGO, N. Y.

[Latitude, 43° 29' N.; longitude, 76° 35' W. Local time, 0.06 slow, Eastern.]

J F M J	29, 660 29, 592 29, 639 29, 657 29, 586 29, 582 29, 582	30. 09 80. 07 30. 17 29. 85 29. 91 29. 82 29. 85	28. 83 29. 07 29. 12 29. 23 29. 15 29. 33 29. 17	8. 6 15. 8 36. 5 49. 8 57. 5 64. 9 61. 1	16. 2 21. 9 41. 5 56. 2 63. 3 70. 1 66. 4	13. 3 18. 4 37. 3 51. 4 58. 5 65. 1 62. 2	12. 7 18. 7 38. 4 52. 5 59. 8 66. 7 63. 2	37 49 85 81 85 90 83	-10 17 28 39 45	21. 6 25. 9 46. 5 60. 5 69. 9 74. 4 69. 5	11. 7 30. 6 43. 3 50. 5 59. 1 56. 7	6. 7 11. 9 29. 0 42. 0 50. 4 58. 7 55. 5	80. 7 43. 1 49. 5 59. 1 55. 7	9. 8 12. 8 30. 1 42. 2 50. 9 59. 8 55. 4	9. 4 12. 9 29. 9 42. 4 50. 3 59. 2 55. 5	92 85 75 75 78 81 82	82 72 64 63 69 70	79 76 72 77 84 79	73
8 0 N D Y		29. 85 29. 96 29. 93 29. 99 80. 84	29. 17 29. 13 29. 14 29. 20 28. 76	61. 1 55. 0 44. 7 38. 1 27. 1	66. 4 62. 9 51. 6 42. 3 30. 6	62. 2 56. 1 46. 7 89. 5 29. 1	63. 2 58. 0 47. 7 40. 0	83 79 72 71 55	47 40 29 15		56. 7 49. 8 40. 9 33. 9 21. 9	55. 5 48. 4 39. 2 32. 5	55. 7 50. 1 41. 2 33. 4 24. 2	55. 4 48. 8 39. 9 33. 5 23. 5	55. 5 49. 1 40. 1 83. 1 23. 1	82 79 82 81 80	70 64 69 72 77		77,

## PALESTINE, TEX.

[Latitude, 81° 45' N.; longitude, 95° 40' W. Local time, 1.22 slow, Eastern.]

J M J J S O N Y	29. 607 29. 451 29. 408 29. 488 29. 447 29. 442 29. 506 29. 521	29. 92 29. 94 29. 79 29. 63 29. 64  29. 60 29. 86 29. 82	29. 21 29. 20 29. 14 29. 29 29. 28 29. 30 29. 22 29. 01	38. 4 47. 9 60. 0 62. 8 72. 9 74. 0 69. 4 54. 9 51. 6	52. 1 61. 7 74. 9 77. 2 86. 1 88. 5 82. 5 71. 2 65. 9	46. 4 54. 2 66. 0 68. 1 76. 5 78. 8 72. 5 60. 2 56. 3	45. 6 54. 6 67. 0 69. 4 78. 5 80. 0 74. 8 62. 1 57. 9	77 79 86 87 92 97 93 83	15 31 47 51 63  64 58 89 85	57. 1 65. 1 77. 4 79. 5 89. 4	36. 1 45. 4 58. 8 61. 2 70. 9 73. 2 68. 0 52. 8 49. 7	31. 2 42. 2 56. 0 59. 3 71. 1 71. 2 66. 2	30. 6 41. 2 58. 0 62. 0 73. 8  72. 8 68. 4 52. 0 44. 7	32. 8 41. 6 57. 5 62. 3 72. 1 78. 2 68. 1 52. 8 46. 8	3L.5 41.7 57.2 61.2 72.2 67.6 51.6 45.1	76 81 87 89 94  92 90 84 76	48 50 58 60 66 64 53 50	63 76 63 87	71 66
¥			•••••	·····					11	••••	••••		••••	••••	•••••		···	1	

# Monthly and yearly meteorological summaries—Continued. OLYMPIA, WASH.

		dine					W	in	d.							Pre	cipi- ion.		N	um	ber	of	day	78-	-	
7 a. m.	3 p. m.	11 p. m.	Mean,	Total (miles).	Maximum.	Direction.	North.	Northeast.	East.	Southeast.	South.	Southwest.	West.	Northwest.	Calms.	Total.	Max. 24 hours.	Clear,	Falr.	Cloudy.	Rain or snow.	Max. below 320.	Min. below 32°.	Max. above 90°.	Thunder-storms.	Auroras.
1385298731	6.1 4.2 6.8 4.9 4.0 5.4 5.8 4.9 7.3	2. 7 3. 9 5. 5 5. 8 3. 2 1. 5 3. 0 7. 4 5. 9	6, 8	905 1, 303 1, 979 1, 883 1, 469 1, 292 2, 719 2, 178 3, 159	17 12 15 14 14 18 15 20 22 31 16	N.	6 2 17 15 14 21 25 28 16 17 1 5 167	1 1 2 5 4 7 1 4	0 0 0 0 0 1 0 2 1 7 0 1 1 2 1 1 2	0 0 0 0 0 0 0 2 7 4 14 4 5	22 35 12 2 17 11 9 40 36 70 50	4 8 3 7 10 10 5 5 12 6 2 12 84	12 15 14	10	51 36 24 26 30 9	7. 67 0. 50 0. 39 2. 84 0. 79 1. 10 0. 00 3. 60 2. 84 10. 18 5. 72		4 10 15 7 4 12 22 9 16 0 4	9 15 15 15 10 10 11	5 20 16	8 7 4 7 2 0 15 9	0 0 0 0 0 0 0 0	4 2 1 3 0 0 0 0 0 0 0 0 0 1 1 5 1 1 1 1 1 1 1 1	0 0 0 3 1 0 0	0000024000006	0000

	OMAHA, NESK. [H=1,118. A=71.]  15.43.23.9 5.37132 N. 22 0 1 7 25 10 4 17 7 0.410.19 14 13 4 821 30 0 0 0													
3, 15, 43, 23, 9, 6, 371, 32 4, 45, 33, 24, 3, 5, 884, 30 3, 14, 53, 13, 6, 8, 027, 38 6, 90, 94, 95, 97, 76, 73, 8 4, 15, 13, 94, 4, 6, 645, 32 6, 64, 93, 94, 9, 5, 98, 85 4, 94, 64, 24, 6, 5, 527, 36 4, 85, 23, 44, 5, 5, 217, 27 6, 84, 62, 43, 9, 6, 778, 29 5, 45, 44, 5, 5, 15, 640, 32 6, 85, 43, 84, 7, 6, 630, 50 6, 85, 23, 64, 5, 76, 459 6, 85, 23, 84, 7, 6, 630, 50 6, 85, 23, 64, 5, 76, 459	$ \begin{array}{cccccccccccccccccccccccccccccccccccc$													

#### OSWEGO, N. Y. [H=335. h=83.] 8. 6.8. 6.8. 6.8. 4.12, 045 48 7. 9.8. 26. 9.7. 6.8. 856 39 7. 8.7. 5.5. 7.7. 0.9. 995 38 4. 9.5. 44. 7.5. 0.7. 986 34 6. 9.6. 14. 15. 4.6. 795 26 5. 44. 34. 6. 6. 6. 831 36 6. 23. 83. 5. 4. 2. 5. 760 22 6. 38. 35. 96. 2. 6. 258 36 8. 54. 63. 44. 6. 7. 044 38 8. 58. 6. 8. 7. 8. 645 34 9. 9.8. 9.7. 98. 611, 750 34 9. 9.8. 9.7. 98. 611, 750 34 w.sw 2. 02 0. 75 1, 22 0. 64 0. 48 0. 21 1. 86 0. 71 5 1 4 1 5 2 11 15 11 OJ. 20 16 2: 0 1 F. 0 1 M. 0 0 A. 2 2 M. 6 1 J. 28 20 7 12 14 15 24 0 20 10 11 13 19 11 3 N. SE. NE. 1. 86 0. 71 3. 37 0. 83 3. 94 2. 39 4. 89 2. 33 2. 37 0. 90 3. 62 L. 49 3. 33 1. 50 23 7 12 11 8 5 R 24 19 10 13 SE. SE. SE. SE. NW. 13 15 16 10 11 22 14 6 12 13 11 11 11 8 9 0 A. 0 S. 0 10 0 3 0 S. 0 0 0 O. 0 0 0 N. 0 0 0 D. 14 17 16 12 3 15 5 12 7 5 0 2.17 0.50 0 3.87 L.86 110 74 27 171 246 105 222 128 12 33, 14 2, 39 62 143 160 161 71 150 6. 26, 65, 86, 297, 446 0 29 5 Y.

	PALESTINE, TEX. [H=533, A=2.]
5, 75, 84, 65, 4 8, 085 32 NW., SW. 5, 54, 33, 74, 5 7, 65431 S. 5, 15, 84, 85, 2 7, 293; 25 NW. 6, 55, 74, 55, 6 7, 57440 NE. 6, 15, 62, 95, 2 5, 58144 W. 4, 54, 72, 94, 0 5, 680; 32 NW. 4, 55, 41, 83, 9 5, 629; 29 S. 5, 76, 03, 14, 9 5, 689; 38 NW. 4, 43, 2, 13, 3 6, 537; 30 S. 4, 34, 32, 13, 9 6, 923; 32 S. 4, 34, 32, 13, 9 6, 923; 32 S. 4, 34, 32, 13, 9 6, 923; 32 S.	15 24 8 4 16 6 6 14 0 7.77 3.42 8 14 9 10 3 14 0 2 0 J.

## PENSACOLA, FLA.

[Latitude, 30° 25' N.; longitude, 87° 13' W. Local time, 0.49 slow, Eastern.]

		(Trees	uae, s	25	N.; I	ongit	uue, e	7	0 1	v. 1	OCAL T	ime, 0	49 BIO	W, E&	stern.				
	Pre	88ure.				Ter	npera	tur	е.				Dow p	oint.		h	Rola	dit	ь у. —
l year.										Ме	an.								
Months and	Mean.	Maximum.	Minimum.	7 a. m.	3 р. п.	11 р. ш.	Мевп.	Maximum.	Minimum.	Maximum.	Minimum.	7 a.m.	3 p. m.	11 p. m.	Moan.	7 a. m.	8 p. m.	11 p.m.	Mean.
J F M J J S ON Y	In. 30. 159 30. 039 30. 118 30. 038 29. 930 30. 020 30. 018 29. 962 29. 937 29. 977 30. 046 30. 174 30. 035	In. 30. 50 30. 42 30. 50 30. 32 30. 09 30. 16 30. 20 30. 14 30. 09 30. 24 30. 52 30. 52	In. 29. 80 29. 56 29. 79 29. 64 29. 80 29. 74 29. 72 29. 68 29. 77 29. 74 29. 56	0 46. 0 44. 6 48. 9 62. 7 76. 9 78. 2 77. 4 74. 7 59. 2 53. 0 44. 4 61. 2	86. 1 85. 0 83. 2 71. 6 63. 2 57. 1		72. 8 80. 5 81. 6	69 77 84 86	0 24 24 31 42 54 67 69 72 65 43 33 28 24	58. 6 59. 1 63. 0 74. 0 80. 5 88. 7 89. 1 88. 6 84. 3 73. 1 65. 5 59. 4 73. 7	42.6 47.3	0 40. 1 37. 1 42. 8 57. 2 62. 3 71. 1 72. 4 74. 4 74. 1 52. 5 45. 8 35. 6 55. 2	o 41. 5 40. 8 45. 8 58. 5 63. 3 72. 1 74. 4 75. 5 73. 3 56. 8 50. 2 7 57. 9	0 41. 6 89. 7 46. 4 59. 5 63. 4 72. 1 72. 2 74. 1 72. 2 53. 6 48. 5 41. 0 57. 0	39. 2 45. 0 58. 4 63. 0 71. 8	81 83 81 83 83	62	74 68 76 82 77 81 78 83 86 72 76 73	73 68 72 76 73 76 77 83 83 71 73 70
	'	[L	titude	, 390	57′ N.		IILA					time,	0.00, E	aster	n.]	'			
J F M A J J S O N Y	30. 000 29. 869 39. 929 29. 915 29. 843 29. 850 29. 850 29. 867 29. 992 29. 992 29. 902 29. 837 29. 898	30. 73 30. 40 30. 36 30. 48 30. 19 30. 18 30. 08 30. 15 30. 28 30. 21 30. 25 30. 64 30. 78	29. 21 28. 97 29. 47 29. 38 29. 46 29. 36 29. 61 29. 52 29. 35 29. 50 29. 14	27. 9 20. 3 26. 3 44. 0 54. 6 65. 9 71. 7 67. 7 60. 0 50. 7 41. 5 33. 2 47. 0	32. 8 26. 8 35. 9 58. 1 67. 0 79. 1 85. 5 78. 3 73. 0 60. 6 49. 5 40. 4	29. 1 23. 1 30. 2 47. 4 57. 8 66. 9 74. 5 69. 4 62. 6 53. 2 43. 9 36. 4 49. 5	29. 9 23. 4 30. 8 49. 8 59. 6 70. 6 77. 2 71. 8 65. 2 54. 8 45. 0 36. 7 51. 2	64 56 61 87 84 93 97 91 85 78 71 60 97	6 0 6 27 41 52 57 51 44 35 29 15 0	38. 2 31. 5 38. 6 60. 9 69. 0 80. 8 87. 8 81. 6 75. 8 63. 4 51. 9 44. 6 60. 3	22. 2 23. 1 40. 4 51. 2 61. 3 68. 6 64. 9 57. 4 47. 4 38. 1 29. 5	19. 9 12. 0 17. 6 36. 0 47. 5 55. 2 63. 4 62. 2 52. 8 46. 2 35. 5 25. 5 39. 5	20. 0 18. 4 22. 1 41. 5 49. 4 54. 1 62. 1 61. 1 53. 2 46. 6 37. 5 26. 3 41. 0	20. 0 15. 6 21. 9 38. 3 48. 8 55. 2 64. 6 62. 8 54. 6 47. 5 37. 6 28. 4 41. 3	20. 0 15. 8 20. 5 88. 6 48. 6 54. 8 63. 4 62. 0 53. 5 46. 8 36. 9 26. 7 40. 6	72 71 69 74 79 70 76 83 78 85 80 73 76	61: 71: 59: 57: 56: 44: 46: 57: 52: 65: 58: 57:	70 78 71 72 75 68 72 80 76 81 79 73 74	68 71 67 68 70 60 65 74 69 75 69
		[Latit	nde, 38	o 50' ]	N. ; lo		KE'S de 10					me, 2.0	0 alow	, Eas	tern.]	——· I			
J F M J J S O V	17. 495 17. 453 17. 679 17. 670 17. 777 18. 092 18. 069 17. 968 17. 858 17. 694 17. 640 17. 778	17. 84 17. 88 17. 87 17. 89 18. 13 18. 21 18. 22 18. 10 18. 05 18. 11 18. 22	17. 44 17. 14 17. 57 17. 51 17. 94 17. 90 17. 65 17. 59 17. 10 17. 18	0. 3 1. 1 6. 6 12. 6 17. 6 26. 2 35. 4 83. 3 27. 2 18. 6 11. 8 7. 5	19. 5 24. 8 33. 9 44. 6 42. 2 35. 8 24. 2 16. 6 10. 8	37. 7 35. 7 30. 1 20. 9 12. 9 8. 0	1. 4 1. 9 9: 3 15. 8 21. 1 29. 8 39. 2 37. 1 31. 0 21. 2 13. 8 8. 8 19. 2	23 28 39 44 57 52 47 36 33 26	-29 -24 -12 - 5 10 24 24 16 13 - 1 - 9 -20 -29	6. 7 7. 6 14. 7 21. 5 26. 6 36. 7 47. 0 42. 9 38. 1 26. 8 18. 4 14. 6 25. 2		-4. 7 -5. 3 2. 2 9. 4 14. 2 21. 4 29. 5 28. 8 22. 6 14. 2 8. 0 2. 9 11. 9	-4. 4 0. 8 5. 9 16. 7 21. 8 27. 5 35. 8 33. 7 27. 6 18. 6 12. 1 7. 1	-3. 9 -2. 2 4. 2 13. 0 18. 8 25. 3 33. 5 82. 2 24. 8 15. 9 9. 3 4. 3 14. 6	-4. 3 -2. 2 4. 1 13. 0 18. 3 24. 7 82. 9 31. 6 25. 0 16. 2 9. 8 4. 8 14. 5	81 82 83 87 86 82 79 84 82 82 82 82 83	71 83 75 89 88 73 73 73 79 83 85 79	79 83 83 90 91 85 85 86 81 81 86 85	77 83 89 89 88 81 79 81 84 84 84
		[Latit	tude, 4	00 32 [,]	N. ; l		PITT ide, 8					me, 0.2	0 alow	East	tern.]				
J F M A M J J S O N D Y	29, 256 29, 140 29, 211 29, 212 29, 116 29, 210 29, 166 20, 157 29, 248 29, 173 29, 137 29, 137 29, 186	29, 69 29, 56 29, 66	28, 39 28, 70 28, 70	19.6 26.0 43.7	36.1 58.2	23. 7 31. 0 48. 1	24. 0 31. 0 50. 0	52 61 89	- 9 5 25	33. 2 39. 5 61. 1	22. 4 39. 2	19. 0 34. 2	19.3 21.7 34.7	21. 3 18. 5 22. 2 35. 9 48. 0 56. 2 64. 1 61. 1 54. 6 34. 3 27. 2 40. 6	17. 9 21. 3 34. 9	85 78 71	68 57 46	72 61 65	78 60 60 60 61 65 71 70 71 71 72

# Monthly and yearly meteorological summaries—Continued. PENSACOLA, FLA. [H=80. h=85.]

										L ⁴	u = :	3U.	n=	280.	ı												
		dine					12	Wii	nd.							Prec			Nu	ımb	er	of d	ays	-			Ī
7 a.m.	3 p.m.	11 p.m.	Mean.	Total (miles).	Maximum.	Direction.	North.	Northeast.	East,	Southeast.	South.	Southwest.	West,	Northwest.	Calms.	Total.	Max. 24 hours.	Clear.	Fair.	Cloudy.	Rain or snow.	Max. below 32°.	Min. below 32°.	Max. above 900.	Thunder-storms.	Auroras.	Months and year.
5. 2 4. 3 5. 3 5. 3 5. 3 6. 3 6. 5 5. 3 8. 3 8. 3 8. 5 8. 5 8. 5 8. 5 8. 5 8. 5 8. 5 8. 5	4. 6. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1.	72.03.02.03.13.13.13.13.13.13.13.13.13.13.13.13.13	43.6 44.9 55.7 56,9 4.9 14.6 3.5	5, 805 5, 107 5, 913 5, 925 4, 326 4, 143 4, 335 4, 595 5, 175	0 32 7 24 8 28 8 28 8 27 9 35 1 18 1 32 2 37	W. E. NE. N. NE. SW.	22 28 11 10 7 10 7 5 19 20 17 178	3 9 18 10 6 9	6 11 6 2 5 3 13 11 6 12	3 7 25 7	17 40 29 20 22 16 8 12 7	10 27 18 17 10 8	2 1 5 1 5 8	13 7 13 21 18 20	5 6 4 6 5 12 2 1 0 3	3. 20 4. 54 5. 49 1. 42 3. 98 2. 41 11. 74 5. 50 2. 38 11. 07	2, 25 2, 17 4, 81 4, 23	12 14 13	9 13 12 16 20 13 22 20 19 11 7 14 176	14 5 6 2 6 3 8 11 8 9 4 79	144 9 100 6 5 13 18 17 15 6 14 5 132	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0 5	0 0 7 11 13 0 0	1 0 15 11 8 0 0	000000000000000000000000000000000000000	J A SONDY
									P					[A, =16													
5.3 5.0 6.0 6.4	3. 9 6. 1 5. 6 7. 6	3. 14. 12. 13. 13. 13. 13. 13. 13. 13. 13. 13. 13	24.8 24.4 5.3 14.2 16.0 14.1	7, 038 8, 115 7, 518 6, 450	37 5 34 6 47 2 29	W. NW. NW. NW. NW.	8 10 14 12 12 10	7 12 36	5	2 1 2 5 4 6	. 8	0 7 10 3	11 15 16 8	27 28 13 7	5 11 5 7 7	2. 79 0. 69 2. 54 3. 76	1, 02 1, 08 0, 24 0, 82 1, 78 0, 42	8 6 10 3	18 16 20	5748	11 15 7 8 15 0	16 9 0	25 4 0	0 0 0 0	1 1 2	0 3 0	M M J

#### 8. 0.5. 0.2. 0.3. 7 6, 219 33 8 W. 8. 0.4. 44. 14. 2 6, 431 28 8 W. 8. 8. 3. 7 3. 4 3. 6 6, 128 33 NW. 4. 0.5. 4 3. 2.4. 2 6, 256 36 NE. 8 9 9 10 12 19 11 13 2 2 39 0 86 11 20 0 10 0 14 6 0 J. 6. 80 2. 50 0 A. ò 8, 8| 3, 7| 3, 4| 3, 6| 6, 128 4, 0| 5, 4| 3, 2| 4, 2| 6, 256 6, 6| 7, 1| 4, 8| 6, 2| 7, 828 5, 2| 4, 7| 4, 4| 4, 8| 9, 129 4, 9| 5, 3| 3, 6| 4, 6| 87, 049 6, 128 33 6, 256 36 7, 828 32 17 1, 17 0, 58 3, 33 1, 12 S. 24.00 11 Ď. θ 6 0 18 0 NE. NW. ĭ 3, 35 1, 58 17 Q N. D. 9, 129 37 2, 87 1, 32 ß D. ... 18 19 3 Y. 101 158 46 58 144 157 138 242 51 33, 35 2, 50 100 188 68 124 PIKE'S PEAK, COLO.

#### [H=14,134. h=1.]2. 9 4. 1 2. 0 3. 0 13, 816 88 NW. 3. 7 4. 8 4. 5 4. 3 11, 611 76 NW. 2. 7 9, 9 3, 7 4. 5 15, 950 72 NW. 4. 0 7. 3 5, 15. 8 15, 012 80 W. 3. 7. 9 4. 6 5. 3 13, 797 74 SW. 1. 8 6. 2 4. 0 4. 0 14, 473 78 W. 2. 6 6. 7 5, 6 5. 0 9, 523 56 W. 2. 6 6. 3 3. 3 4. 1 11, 441 54 NW. 2. 2 4. 8 2. 5 3. 2 10, 956 82 NW. 2. 7 4. 2 2. 7 8. 2 17, 057 72 NW. N. 2. 7 4. 5 3. 9 8 10, 965 90 W. 2. 7 4. 5 3. 9 8 10, 965 90 W. 0 0 J. 0 0 F. 0 0 M. 4 0 A. 11 0 M. 0. 61 0. 35 8 9 B 3. 91 0. 85 3. 91 0, 85 0, 88 0, 47 5, 39 3, 42 6, 12 2, 45 1, 39 0, 63 2, 67 0, 48 2, 04 0, 37 7 6 21 22 n 12 3 21 33 23 23 0 11 0 5 0 18 0 12 0 7 0 J. 0 J. 17 24,24,24 5 23 23 31 A. S. O. 24 27 25 19 1. 04 0. 49 1. 53 1, 35 R 7 20 0. 87 0. 44 4. 03 1. 64 0 D, 0 0 8, 0 5, 5 3, 7 4, 1 167,692 139 109 33 44 167 315 239 27 30, 48 3, 42 149 166 50 158 242 315 0.57 Y,

	PITTSBURG, PA [H=766. h=86.]
5. 9 7. 4 4 . 5 5 . 9 5 . 809 32 W. W. T. 17. 2 6 . 4 6 . 9 5 . 209 25 S. 8. 4 . 5 . 5 . 9 4 . 098 23 S. 8 W. T. 17. 2 6 . 4 6 . 9 5 . 209 25 S. 8 W. T. 15 . 6 6 . 2 4 . 071 21 S. 1 . 5 . 7 . 5 . 6 . 2 4 . 071 21 S. 5 . 7 . 5 . 6 . 3 . 9 5 . 4 . 16 . 2 3 S. 5 . 7 . 5 . 6 . 3 . 9 5 . 4 . 3 . 705 23 S. 5 . 8 6 . 6 . 3 . 9 5 . 4 . 3 . 705 23 S. 5 . 6 . 6 . 3 . 9 5 . 4 . 3 . 705 23 S. 7 . 9 . 7 . 7 . 0 7 . 9 4 . 900 24 S. 7 . 9 . 7 . 7 . 0 7 . 9 4 . 900 24 S. 7 . 4 . 8 . 1 6 . 9 7 . 5 . 6 . 013 28 S. 8 . 2 8 . 8 . 2 8 . 8 . 8 . 9 . 5 . 2 . 8 . 8 . 2 . 8 . 8 . 8 . 9 . 5 . 2 . 8	2, 5 9 4 14 16 20 20 3 4 03 1.24 5 15 11 19 11 23 0 0 0 0 3 8 7, 5 3 8 12 21 16 4 1.90 0.46 3 12 13 20 12 25 0 0 0 15 10 4 4 1 12 12 17 20 7 1.14 0.31 3 15 13 20 8 25 0 0 0 18 16 6 6 9 4 10 10 10 10 16 2.79 0.74 9 8 13 15 0 9 0 3 0 4 10 9 11 10 9 9 11 11 13 3 .26 1.26 16 16 9 15 0 0 0 4 0 11 14 2 12 12 17 20 9 2.68 1.42 11.18 1 13 0 0 3 6 0 3 14 2 4 3 14 12 9 25 10 2.49 0.80 8 16 7 12 0 0 15 11 0 3 14 2 4 3 14 12 9 25 10 2.49 0.80 8 16 7 12 0 0 15 11 0 3 10 6 3 8 5 12 5 11 14 29 12 15 6 42 61 5 18 8 14 0 0 6 14 0 3 6 6 3 8 5 12 5 11 14 29 4.29 1.32 0 14 8 16 0 0 0 0 2 0 8 6 3 8 5 12 5 11 14 29 4.29 1.32 0 14 8 16 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0

POPLAR RIVER, MONT.

		[Lati	tude, 4	80 <b>8</b> / 3	N.; lo	ngitu	de, 10	50	7 0	v. 1	ocal t	ime, 2	rola 00.	r, Eas	tern.	1_			
	Pr	068UT0	•			Tei	npers	tar	е.				Dow p	oint.			Rela umi		
nd year.		ä	•					i		Me	an.								
Months and	Mean.	Maximum	Minimum	7 a. m.	3 р. т.	11 р. ш.	Mean.	Maximum	Minimum	Maximum	Minimum	7 a. m.	3 p. m.	11 p. m.	Mean.	7 a. m.	3 p. m.	11 p. m.	Mean.
J F M.	In. 27. 880 27. 851 27. 937	In. 28. 43 28. 28 28. 27	27. 19 27. 60	19. 0	31. 9	1.0 27.0	26. 0	40 53	- 1	11.6 36.2	o -16. 1 -10. 3 17. 0	-12. 8 - 7. 8 17. 1	o - 2. 1 5. 8 28. 7	o - 2. 5 0. 3 25. 7	o - 5. 8 0. 9 23. 8	94 92	93 91 88	93 94 95	94 93 92
M.J J J S O N T	27. 804 27. 785 27. 829 27. 778 27. 914 27. 709 27. 806 27. 771 27. 825 27. 837	28. 18 28. 21 28. 09 28. 18 28. 16 28. 20 28. 13 28. 29 28. 43	26. 27 27. 40	34. 0 43. 0 56. 4 57. 3 50. 8 40. 4 24. 2 24. 8 11. 9 29. 0	69. 2 56. 3 41. 7 28. 0	52. 8 61. 3 64. 8 58. 6 53. 6	43. 3 54. 1 63. 5 66. 6 60. 4 54. 4 41. 3 32. 2 19. 5 38. 1	91 91 82 55 61	18 22 36 42 36 24 9 10 -15 -63	60, 6 77, 5 82, 1 74, 3 72, 7 59, 4	32. 2 38. 9 50. 0 53. 2 47. 7 38. 2 26. 9 21. 4 8. 9 25. 7	30, 8 38, 4 52, 6 52, 2 47, 5 36, 2 23, 7 21, 1 6, 0 25, 4	43. 2 49. 8 62. 4 62. 4 54. 6 51. 6 32. 4 32. 7 20. 2 36. 8	36. 6 45. 6 57. 7 58. 1 53. 0 44. 1 30. 5 24. 9 12. 9 32. 2	36. 9 44. 6 57. 6 51. 7 44. 0 28. 9 26. 2 13. 0	84 89	58 71 61 57 58 43 71 73 69	78 88 80 83 73 72 80 78 83	80 73 82 75 76 79 76 80
		[Lati	tude, 4	8º 7'	N.; lo						ASH.		4 slow	, Eas	tern.]			'	
J M M J S O N	30, 005 30, 166 30, 044 29, 941 29, 999 30, 003 29, 909 29, 910 29, 993 29, 720 80, 000	30, 46 30, 51 30, 28 30, 17 30, 23 30, 24 80, 22 30, 19 30, 28 30, 17 30, 48	29. 57 29. 84 29. 63 29. 63 29. 69 29. 77 29. 74 29. 53 29. 64 29. 05	38. 4 36. 8 37. 1 44. 3 48. 8 50. 9 49. 4 48. 3 42. 3 40. 1 38. 0	47. 0 49. 8 52. 2 55. 2 58. 1 64. 0 60. 6 56. 8 52. 8 47. 3 43. 8	46. 4 51. 8 55. 8 59. 4 56. 2 53. 5	44. 7 45. 2 50. 4 54. 2 58. 1 55. 4	52 58 58 67 72 69 82 74 67 64 55	24 28 30 30 35 37 44 43 38 30 26 14	41. 4 49. 8 53. 3 55. 2 67. 8 61. 6 60. 4 55. 6 49. 4 45. 5 55. 2	36. 6 35. 9 43. 1 48. 0 49. 9 48. 1 46. 7 39. 3 34. 6 80. 6	36. 5 87. 2 35. 3 42. 8 40. 5 48. 9 47. 9 47. 2 41. 4 39. 3	42. 3 45. 1 44. 5 49. 7 50. 7 53. 3 54. 0 53. 4 47. 6 43. 8	40. 0 43. 0 42. 1 48. 5 50. 2 51. 6 45. 3 40. 2 38. 0	39. 6 41. 8 40. 6 47. 0 49. 1 51. 8 51. 4 50. 7 44. 8 41. 1 38. 5	94 93 94 92	84 85 76 82 77 70 79 89 83 88	90 91 85 86 82 81 87 93 96 96	89 85 85 12 87 93 94 94 94
_	N 29.720 30.17 29.05 40.1 47.3 41.3 42.9 55 26 49.4 34.6 39.3 43.8 40.2 41.1 97 88 96 94 D 30.000 30.48 29.47 38.0 43.8 38.9 40.2 53 14 45.5 30.6 37.3 40.2 38.0 38.5 97 88 97 94 Y																		
J M M J S V Y	29. 352 29. 268, 29. 338, 29. 342, 29. 324, 29. 284, 29. 288, 29. 288, 29. 288, 29. 288, 29. 235, 29. 292, 29. 300	29, 93 29, 83 29, 74 29, 70 29, 50 29, 55 29, 61 29, 65 29, 68 29, 07 29, 97	28, 66 28, 76 28, 84 28, 99 29, 05 28, 73 28, 84 28, 73	13. 0 4. 9 14 1 36. 1 45. 8 57. 6 65. 5 58. 7 53. 2 42. 7 36. 8 25. 6 37. 8	19. 7 15. 8 23. 1 43. 4 56. 0 67. 6 68. 6 66. 4 51. 5 41. 1 30. 3 46. 6	18. 5 38. 5 48. 2 60. 4 66. 9 61. 8 57. 3 45. 0 38. 3 27. 5 40. 8	10. 6 18. 6 39. 3 50. 0 61. 9 69. 3 63. 0 46. 4 38. 7 27. 8 41. 7	42 46 80 81 86 90 82 86 71 66 49	26 40 52 45 39 25 27 - 2 -25	23. 8 20. 3 27. 8 48. 7 59. 7 72. 5 78. 6 71. 4 68. 4 43. 6 34. 1 50. 3	61. 7 55. 4 50. 4 39. 8 33. 6 21. 8 33. 8	8, 5 0, 8 9, 8 81, 9 41, 3 52, 2 60, 6 49, 5 39, 6 83, 0 22, 2 83, 6	13. 2 10. 2 15. 2 32. 1 43. 3 54. 2 62. 2 58. 5 53. 9 43. 1 24. 7 23. 7	11. 9 7. 7 14. 3 81. 8 42. 2 53. 5 60. 8 56. 4 51. 9 42. 0 34. 8 23. 9 35. 9	11. 2 6. 2 13. 1 31. 9 42. 3 53. 3 61. 2 56. 4 51. 8 41. 6 34. 2 23. 3 85. 5	85 84 83	76 79 73 66 65 68 65 71 66 74 78 76	84 86 81 78 81 79 61 83 89 87 86 83	81 88 76 77 75 78 84 84 80 80
_	·· <del></del> ,	[Lati	tude, 4	30 39	N.; 1		POR					ime, 0.	19 fast	, Eas	tern.]				
J M J S N D Y	29. 941 29. 851 29. 904 29. 913 29. 852 29. 832 29. 850 29. 898 29. 917 29. 798 29. 809 29. 876	30. 72 30. 30. 46 30. 47 30. 30. 30 30. 18 30. 12 30. 14 30. 26 30. 27 30. 28 30. 57 30. 72	28, 83 29, 27 29, 38 29, 30 29, 50 29, 47 29, 13 29, 41 29, 41 28, 86	22. 4 42. 4 51. 2 62. 1 66. 2 53. 8 44. 1 35. 8 24. 7	26. 3 33. 5 52. 2 61. 3 71. 9 72. 2 68. 6 62. 9 52. 5 42. 2 30. 3	19. 8 26. 3 43. 7 52. 0 62. 0 64. 4 61. 6 54. 4 45. 9 37. 2	20. 3 27. 4 46. 1 54. 8 65. 3 67. 6 64. 1 57. 0 47. 5 38. 4	46 52 72 82 90 87 85 68 55 55	- 5 28 35 47 54 47 38 30 20	64. 2 75. 4 76. 2 71. 5 65. 8 54. 9 44. 2 34. 6	12. 0 19. 7 38. 4 47. 1 56. 4 59. 7 57. 0 47. 5 40. 9 33. 2	14. 6 16. 3 14. 1 83. 4 42. 9 52. 3 60. 4 56. 3 47. 5 40. 7 31. 2 19. 3 35. 0	15. 3 19. 3 34. 8 45. 4 55. 3 60. 1 58. 6 50. 7 43. 7	16.4	10. 9 16. 6 34. 2	70 71 74 71 83 82 80 88 83 80	65 64 56 54 58 58 58 72 66 77 76 71 65	69 65 65 76 76 78 85 84 78	211251272899993

## POPLAR RIVER, MONT. [H=20.30. k=1.]

	[H=20.30. h=1.]	<u> </u>												
Cloudiness (in tenths).	Wind.	Precipitation. Number of days—												
7 a. m. 8 p. m. 11 p. m. Mean.	Total (miles).  Maximum.  Direction.  North.  Northeast.  Enst. Southeast. Southeast.  Southwest.  West.  Northwest.	Total.  Max. 24 hours. Clear. Fair. Cloudy. Rain or snow. Max. below 320. Min. below 320. Max. above 300. Thunder-storms. Autonas.												
5.05.65.05.2 5.24.84.04.7 6.15.84.75.5 4.45.04.14.5 5.04.83.03.5 3.95.03.94.63 8.94.63.84.1 3.13.42.84.1 9.3.73.34.0 7.26.63.63.36.5 4.85.03.94.6	2,952,266   W.   2,311   2,1   1,34   72   1,5   5,25   3,4   1,31   14   W.   18   7,3   7,8   6,27   14   N.W.   18   7,3   7,8   6,27   14   5,823   32   SE.   E.   9,522   9,11   8,8   6,597   60   N.   14, 1,7   8,2   3,19   8,8   63   10,10   10,2   4   10,8   10,309   34   N.   11,10   2,3   5,9   21,10   20,3   10,3   10,10   2,983   36   N.   10,10   2,5   15,7   2,633   6,000   15,5   5,3   7   2,63   21,10   15,5   3,7   2,63   21,10   15,5   3,7   2,63   21,10   15,5   3,7   2,63   21,10   15,5   3,7   2,63   21,10   15,5   3,7   2,63   21,10   15,5   3,7   2,63   21,10   15,5   3,7   2,63   21,10   15,5   3,7   2,63   21,10   15,5   3,7   2,63   21,10   15,5   3,7   2,63   21,10   15,5   3,7   2,63   21,10   15,5   3,7   2,63   21,10   15,5   3,7   2,63   21,10   15,5   3,7   2,63   21,10   15,5   3,7   2,63   21,10   15,5   3,7   2,63   21,10   15,5   3,7   2,63   21,10   15,5   3,7   2,63   21,10   15,5   3,7   2,63   21,10   15,5   3,7   2,63   21,10   15,5   3,7   2,63   21,10   15,5   3,7   2,63   21,10   15,5   3,7   2,63   21,10   15,5   3,7   2,63   21,10   15,5   3,7   2,63   21,10   15,5   3,7   2,63   21,10   15,5   3,7   2,63   21,10   15,5   3,7   2,63   21,10   15,5   3,7   2,63   21,10   15,5   3,7   2,63   21,10   15,5   3,7   2,63   21,10   15,5   3,7   2,63   21,10   15,5   3,7   2,63   21,10   15,5   3,7   2,63   21,10   15,5   3,7   2,63   21,10   21,10   21,10   21,10   21,10   21,10   21,10   21,10   21,10   21,10   21,10   21,10   21,10   21,10   21,10   21,10   21,10   21,10   21,10   21,10   21,10   21,10   21,10   21,10   21,10   21,10   21,10   21,10   21,10   21,10   21,10   21,10   21,10   21,10   21,10   21,10   21,10   21,10   21,10   21,10   21,10   21,10   21,10   21,10   21,10   21,10   21,10   21,10   21,10   21,10   21,10   21,10   21,10   21,10   21,10   21,10   21,10   21,10   21,10   21,10   21,10   21,10   21,10   21,10   21,10   21,10   21,10   21,10   21,10   21,10   21,10   21,10   21,10   21,10   21,10   21,10   21,10   21,10   21,10   21,10   21,10   2	17a.   17a.   17b.   17b.												
	PORT ANGELES, W [H=14. k=1.]	ASH.												
1.01.81.51.4 4.45.14.44.6 4.43.84.04.1	1 4 11 9 4 7 21 2 3 045 30 W 4 9 3 0 24 10 23 8 4 142 23 NW 1 4 4 3 26 6 18 29 5 105 28 NW 2 2 2 1 1 20 11 13 36 4 225 24 NW 1 5 8 0 30 9 11 23 3 830 23 NW 2 4 8 9 34 4 16 16 2 686 20 NW 2 4 8 9 34 4 16 16 2 721 20 W 2 612 6 52 2 6 6 2 707 20 SW 1 6 2 6 58 5 7 1	9 0.71 0.46 19 8 3 5 0 10 0 0 0 0 0 1 1 A. 2 1.47 0.51 9 10 12 9 0 0 0 0 0 0 0 0 M. 3 0.67 0.40 6 18 6 7 0 0 0 0 0 0 0 J. 6 0.03 0.03 16 11 4 1 0 0 0 0 0 0 J. 0 0.00 0.00 24 7 0 0 0 0 0 0 0 0 A.												
	52.9.3.1 3.2 2 4, 225.24 NW. 2 4 8 9 34 4 16 16 0 0.00 0.00 24 7 0 0 0 0 0 0 0 0 0 0 4 4 3.84 0.4.1 2, 721.20 W. 2 612 6 52 2 6 6 1 2.44 0.53 12 14 5 12 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0													
5.5 5.6 4.2 5.1 8.8 5.5 3.7 4.3 2.9 4.7 3.5 3.7 8.2 4.7 4.0 4.0 5.6 7.0 3.9 5.5 4.7 5.2 2.9 4.3 5.1 6.9 5.8 5.9 9.1 9.2 7.7 8.7	8, 305 33 W. 2 6 1 4 35 15 19 11 4 75 22 N.W. 2 7 2 8 14 20 11 8 14 6 5 75 35 W. 8W. 9 13 3 3 11 17 18 14 6 5 6 31 3 W. 15 15 19 11 17 18 14 6 7 6 2 1 4 6 1 6 7 6 2 1 4 6 1 6 7 6 2 1 4 6 1 6 7 6 2 1 4 6 1 6 7 6 2 1 4 6 1 6 7 6 2 1 4 6 1 6 7 6 2 1 4 6 1 7 6 8 8 15 27 3 1 2 4 7 6 8 8 15 27 3 1 2 4 7 6 8 8 15 27 3 1 2 4 7 6 8 8 15 27 3 1 2 4 7 6 8 8 15 27 3 1 2 4 7 6 8 8 15 27 3 1 2 4 7 6 8 8 15 27 3 1 2 4 7 6 8 8 15 27 3 1 2 4 7 6 8 8 15 27 3 1 2 4 7 6 8 8 15 2 1 3 1 2 4 7 6 8 8 15 2 1 3 1 2 4 7 6 8 8 15 2 1 3 1 2 4 7 6 8 8 15 2 1 3 1 2 4 7 6 8 8 15 2 1 3 1 2 4 7 6 8 8 15 2 1 3 1 2 4 7 6 8 8 15 2 1 3 1 2 4 7 6 8 8 15 2 1 3 1 2 4 7 1 2 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	0 2.87 0.69 8 13 10 15 22 29 0 0 0 0 J. 2 3.39 1.49 7, 14 7, 13 23 28 0 0 0 0 F. 5 0.71 0.20 9 17 5, 14 20 30 0 0 0 M. 0 1.26 0.45 9 14 7, 10 2, 16 0 1 0 A. 2 3.80 2.21 14 10 7, 14 0 1, 0 0 0 M. 1 5.29 1.54 17 7, 6 16 0 0 0 4 0 J. 1 3.28 1.06 5 20 6 17 0 0 0 5 0 A. 0 2.06 1.03 11 15 4 9 0 0 0 0 0 S. 0 2.52 0.52 10 9 12 15 0 5 0 1 0 0. 2 3.10 0.91 0 6 24 20 0 14 0 0 0 N.												
	PORTLAND, M [ <i>H=9</i> 9.													
5.15.14.75.6 5.64.73.94.6 5.64.73.94.7 4.24.24.54.2 4.55.23.94.6 3.94.93.84.2 4.85.03.84.2 4.85.24.74.5 2.63.33.33.1 4.7.05.65.2 4.37.05.65.3 4.37.05.65.3 4.37.05.65.3 4.37.05.65.3 4.37.05.65.3 4.37.05.65.3 4.37.05.65.3 4.37.05.65.3 4.37.05.65.3 4.37.05.65.3 4.37.05.65.3 4.37.05.65.3 4.37.05.65.3 4.37.05.65.3 4.37.05.65.3 4.37.05.65.3 4.37.05.65.3 4.37.05.65.3 4.37.05.65.3 4.37.05.65.3 4.37.05.65.3 4.37.05.65.3 4.37.05.65.3 4.37.05.65.3 4.37.05.65.3 4.37.05.65.3 4.37.05.65.3 4.37.05.65.3 4.37.05.65.3 4.37.05.65.3 4.37.05.65.3 4.37.05.65.3 4.37.05.65.3 4.37.05.65.3 4.37.05.65.3 4.37.05.65.3 4.37.05.65.3 4.37.05.65.3 4.37.05.65.3 4.37.05.65.3 4.37.05.65.3 4.37.05.65.3 4.37.05.65.3 4.37.05.65.3 4.37.05.65.3 4.37.05.65.3 4.37.05.65.3 4.37.05.65.3 4.37.05.65.3 4.37.05.65.3 4.37.05.65.3 4.37.05.65.3 4.37.05.65.3 4.37.05.65.3 4.37.05.65.3 4.37.05.65.3 4.37.05.65.3 4.37.05.65.3 4.37.05.65.3 4.37.05.65.3 4.37.05.65.3 4.37.05.65.3 4.37.05.65.3 4.37.05.65.3 4.37.05.65.3 4.37.05.65.3 4.37.05.65.3 4.37.05.65.3 4.37.05.65.3 4.37.05.65.3 4.37.05.65.3 4.37.05.65.3 4.37.05.3 4.37.05.3 4.37.05.3 4.37.05.3 4.37.05.3 4.37.05.3 4.37.05.3 4.37.05.3 4.37.05.3 4.37.05.3 4.37.05.3 4.37.05.3 4.37.05.3 4.37.05.3 4.37.05.3 4.37.05.3 4.37.05.3 4.37.05.3 4.37.05.3 4.37.05.3 4.37.05.3 4.37.05.3 4.37.05.3 4.37.05.3 4.37.05.3 4.37.05.3 4.37.05.3 4.37.05.3 4.37.05.3 4.37.05.3 4.37.05.3 4.37.05.3 4.37.05.3 4.37.05.3 4.37.05.3 4.37.05.3 4.37.05.3 4.37.05.3 4.37.05.3 4.37.05.3 4.37.05.3 4.37.05.3 4.37.05.3 4.37.05.3 4.37.05.3 4.37.05.3 4.37.05.3 4.37.05.3 4.37.05.3 4.37.05.3 4.37.05.3 4.37.05.3 4.37.05.3 4.37.05.3 4.37.05.3 4.37.05.3 4.37.05.3 4.37.05.3 4.37.05.3 4.37.05.3 4.37.05.3 4.37.05.3 4.37.05.3 4.37.05.3 4.37.05.3 4.37.05.3 4.37.05.3 4.37.05.3 4.37.05.3 4.37.05.3 4.37.05.3 4.37.05.3 4.37.05.3 4.37.05.3 4.37.05.3 4.37.05.3 4.37.05.3 4.37.05.3 4.37.05.3 4.37.05.3 4.37.05.3 4.37.05.	15, 785 41 B. 12 11 3 2 5 4 24 18 8 19 17 5, 949 26 W. 23 5 3 3 14 8 21 13 8 4,675 34 N. 19 10 5 5 26 8 9 7 5 4,627 24 S. 13 2 4 16 20 14 19 5 5 26 8 9 7 7 19 2 12 10 5 3 16 8 14 17 10 10 10 10 10 10 10 10 10 10 10 10 10	6 5 3.6-2.95     12' 11     5' 717' 28' 6' 0' 1 P.       3 1.550     54' 6' 20' 5' 11 8' 27' 0' 0' 1 M.       4 3 2.09-0.64     14' 10' 6' 9' 0' 3' 0' 1 1 A.       14 1.910     61' 12' 13' 6' 11' 0' 0' 0' 0' 2 M.       17 4.606     61' 12' 13' 5' 7' 0' 0' 1 3' 1 J.       10 5.67     1.61' 8' 17' 6' 13' 0' 0' 0' 3' 1 A.       12 1.37     0.53' 17' 10' 3' 8' 0' 0' 0' 1 1 8.       12 1.37     0.53' 17' 10' 3' 8' 0' 0' 0' 1 1 8.       1 4 .32' 1.59     12' 13' 6' 10' 13' 0' 0' 1 N.												

## PORTLAND, OREG. [Latitude, 45° 32′ N.; longitude, 122° 43′ W. Local time, 3-11 slow, Bastern.]

	Pressure.  Temperature.  Dew point.  Relative humidity.    Heart   Hea																		
d year.	Months and year.    Maximum   Maximum   Minimum   Minimu																		
Months and	Mean.	Maximum.	Minimum.	œ	ď.	Ď.	Mean.	Maximum.	Minimum.	Maximum.	Minimum.	ď	Ġ	Ġ	Mean.	d	å	11 р. ш.	Mean.
J F M. A J J S O Y	30, 046 30, 014 30, 074 29, 949	30. 34 30. 40 30. 52 30. 14 30. 17 30. 15 30. 09 30. 15 30. 14 30. 23 80. 40	29, 52 29, 68 29, 76 29, 57 29, 64 29, 62 29, 66 29, 66 29, 11 29, 48	34. 8 44. 4 45. 4 44. 1 51. 2 53. 8 58. 6 56. 4 55. 8 49. 4 44. 3 41. 2	37. 8 50. 0 56. 7 59. 2 64. 5 63. 5 73. 3 73. 3 68. 4 61. 9 50. 7 45. 2	36, 7 47, 2 53, 9 55, 9	36. 3 47. 2 52. 0 55. 9 59. 0 61. 0 68. 0 66. 5 62. 2 56. 0 47. 3 43. 0	55 59 72 82	17 81 33 35	42.7 53.2 63.5 68.3	31.5 41.5 42.9 41.5	80. 9 40. 7 40. 5 89. 0	31. 2 42. 2 42. 0 38. 1	32. 0 42. 0 43. 7 40. 9 47. 4 51. 9 55. 0 55. 3 53. 8 49. 0 43. 0 39. 5	31. 4 41. 6 42. 1 39. 3 47. 1 50. 3 53. 8	87 84 83 86 84	60 48	70 59	82 71 63 68 70 63 67 74 77
		Latit	udo, 34	o 33′ ː	N.; lo		RES					me, 2.3	30 alo	w, Ea	stern.	.]			—'
J F M J J S O N V	24. 747 24. 705 24. 773 24. 666 24. 668 24. 747 24. 814 24. 808 24. 762 27. 774 24. 745 24. 782 24. 749	24. 98 25. 00 25. 00 24. 91 24. 81 24. 93 24. 92 24. 91 24. 92 24. 92 24. 95 25. 07	24. 46 24. 41 24. 56 24. 49 24. 49 24. 70 24. 57 24. 59 24. 30 24. 30	24. 1 29. 4 35. 0 41. 0 45. 6 49. 1 60. 7 61. 2 51. 2 40. 7 34. 9 30. 1 41. 9	42. 5 51. 9 57. 4 61. 8 72. 0 77. 3 84. 7 81. 2 79. 6 71. 2 55. 6 50. 4 65. 5	31. 9 39. 3 45. 6 51. 9 59. 5 64. 0 74. 3 70. 1 63. 9 52. 8 42. 4 36. 0 52. 6	32. 8 40. 2 46. 0 51. 6 59. 0 63. 5 73. 2 70. 8 64. 9 54. 9 44. 3 38. 8 53. 3	57 66 69 80 90 89 98 97 90 84 75 65 98	-4 14 21 28 33 88 48 50 39 30 21 10 -4	45. 8 55. 6 60. 7 65. 8 75. 2 80. 6 88. 4 85. 4 82. 0 74. 1 59. 4 53. 6 68. 9	21. 7 26. 3 82. 5 88. 9 44. 4 47. 3 59. 0 59. 8 49. 3 38. 8 31. 6 26. 1 39. 6	20. 2 23. 1 29. 3 83. 7 36. 1 84. 4 47. 9 52. 9 37. 5 31. 5 31. 6 24. 9 33. 6	23. 7 21. 5 28. 2 23. 8 39. 8 49. 4 52. 9 41. 3 32. 1 33. 5 29. 0 35. 1	25. 0 26. 2 32. 8 35. 2 40. 3 38. 0 49. 8 54. 3 40. 3 33. 7 35. 1 29. 5 36. 7	23. 0 23. 6 30. 1 34. 2 38. 7 36. 3 49. 0 53. 4 99. 7 32. 4 27. 8 35. 1	84 78 80 76 70 58 64 75 60 71 89 82 74	48 32 36 37 33 24 31 40 27 26 48 47 36	75 60 63 54 50 40 45 59 43 50 77 78 58	69 57 60 56 51 41 47 58 44 49 71 69 56
	·	[Lai	itude,	400 10	γ; lor		RED le, 122					ne 3.09	slow,	East	ern.]				
J F M J J S O V	29, 831 29, 797 29, 738 29, 617 29, 548 29, 548 29, 547 29, 492 29, 528 29, 617 20, 625 29, 645	30, 09 30, 07 30, 06 29, 87 29, 77 29, 78 29, 65 29, 67 29, 86 29, 86 30, 01 30, 09	29, 48 29, 53 29, 41 29, 15 29, 29 29, 34 29, 32 29, 34 29, 34 29, 37 29, 47 29, 42	43. 0 46. 8 51. 1 53. 9 58. 6 60. 7 67. 1 69. 6 64. 2 56. 4 49. 5 46. 4 55. 6	50. 9 58. 5 68. 8 68. 7 79. 3 79. 8 89. 5 82. 8 73. 9 55. 6 51. 5 71. 1	48, 6 55, 3 63, 0 63, 6 73, 4 74, 4 85, 5 88, 3 77, 4 66, 4 53, 1 49, 9 66, 6	47. 5 53. 5 61. 0 62. 1 70. 4 71. 6 80. 7 83. 8 74. 8 65. 6 52. 7 49. 3 64. 4	67 73 85 84 100 97 107 108 99 96 71 68	33 34 39 34 44 48 57 58 51 46 38 33 33	56. 1 62. 9 73. 5 73. 1 82. 8 83. 3 93. 1 97. 7 88. 4 78. 6 58. 4 55. 3 75. 3	89, 7 44, 1 48, 0 51, 5 56, 2 64, 4 66, 8 60, 7 53, 5 46, 7 43, 6 52, 8	40, 5 41, 4 42, 1 46, 4 46, 1 48, 7 49, 5 46, 7 44, 9 43, 9 44, 0 45, 2	41. 3 40. 3 40. 5 45. 0 44. 8 47. 0 49. 1 45. 6 43. 9 45. 2 47. 8 44. 5 44. 6	42.6 42.0 44.0 47.0 44.5 45.7 46.2 44.8 47.7 48.1 48.8 44.7	41. 5 41. 5 40. 1 45. 1 45. 1 45. 7 45. 5 45. 7 48. 3 44. 4 45. 2	92 84 73 79 66 66 55 46 51 65 96 92 72	72 55 39 46 31 34 26 21 28 39 78 79 46	82 67 54 58 40 27 24 38 64 87 84 54	82 69 56 61 45 47 38 30 39 55 85 57
		[Latit	ude, 20	5° 23′			RAI ude, 9					me, 1.8	5 slov	r, Eas	stern.	1	•		
J.: M.: M.: J.: J.: S.: ON::	20. 981 29. 858 29. 909 29. 723 29. 769 29. 769 29. 753 20. 729 20. 835 20. 848 20. 947	30. 54 30. 17 30. 20 29. 96 29. 89 29. 88 29. 88 29. 88 30. 09 30. 18	29. 60 29. 58 29. 36	44. 7 49. 2 61. 5 70. 8 72. 6 78. 0 77. 1 76. 6 75. 2 64. 8 58. 6 53. 5	58. 1 63. 5 73. 2 88. 1 86. 8 96. 2 96. 9 96. 5 90. 4 80. 9 77. 9 71. 9	50. 7 55. 4 62. 8 74. 9 76. 4 82. 9 82. 3 82. 4 79. 3 70. 7 65. 7 60. 4	85.4	80 87 92 96 98 104 104 109 100 92 93 88	24 33 49 56 62 70 72 72 68 52 36 32	60. 6 65. 4 75. 7 89. 4 88. 0 97. 5 98. 5 99. 3 92. 0 82. 2 70. 1 73. 1	43. 2 48. 0 60. 0 69. 4 71. 0 77. 3 76. 2 76. 3 74. 9 64. 6 57. 8 52. 2	39. 2 43. 6 56. 6 67. 1 70. 0 72. 4 72. 7 72. 5 72. 8 59. 6 52. 2 48. 6	42. 9 42. 7 58. 2 62. 1 69. 7 68. 2 65. 8 66. 1 71. 6 60. 6 57. 3 49. 3	42.8 45.6 57.6 68.4 70.5 71.0 72.6 62.8 54.3 49.2	41.6 44.0 57.5 65.2 70.1 70.5 69.9 72.3 60.8 54.6 48.4	82 83 84 89 92 83 86 87 98 84 79	68 56 62 45 58 40 87 88 57 52 52 47	76 72 73 76 83 68 68 68 69 81 75 69	74 70 74 78 64 64 65 77 70 67 65

PORTLAND, OREG. | H=80. h=75.]

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	low n to							W	7in	d.							Pre tat	cipi ion.	i-		N	uml	ber	of	day	<b>5</b> -			_
7 a. m.	8 p. m.	11 p. m.	ı١	Mean.	Total (miles).	Maximum.	Direction.	North.	Northeast.	East.	Southeast.	South.	Southwest.	West.	Northwest.	Calms.	Total.	Max 24 hours	Max. 61 Hours.	Clear.	Fair.	Cloudy.	Rain or snow.	Max. below 32°.	Min. below 320.	Max. above 90°.	Thunder-storms.	Auroras.	Months and year.
7.7 8.8 2.5 8.8 5.0 2.5 8.9 3.5 6.5 5.1	6.1 5.1 4.1 4.1	8 6. 0 3. 0 0. 9 3. 3 6.	3 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6	1.6 1.7 1.1 1.6 7.1	2, 218 2, 177 2, 425 2, 701 2, 295 2, 556 2, 955 8, 597 2, 877 8, 76 2, 933 32, 894	5 18 5 18 5 16 5 16 5 14 7 21 1 20 1 30	E., NE. NW. SW. W. SW. NW. S.,SW. S.	11 8 7 8 10 18 16 3 2 3 0 8	1 1 0 0 0 1 2	16 0 4 3 2 0 0 0 0 2 2 5 34	0 1 0 1 1 0 8 13 16 18 16 74	18 29 14 11 19 21 10 3 21 8 39 31 224	2 10 2 0 7 3 5 0 5 3 4 4 0 41	3	42 10 12	14 14	0.6 1.1 4.6 1.7 0.2 0.0 2.4 1.6 8.5	71. 21 30. 20. 91. 70. 40. 80. 23. 72. 93.	28 37 30 85 08 57 24 00 93 64 10 26	4 1 16 19 8 5 11 23 11 16 3 7	10 4 9 8 10 11 13 6 12 8 11 12 114	17 23 6 3 13 14 6 7 16 12 125	19 23 7 6 13 11 1 0 9 23 19 140	000000	17 1 0 0 0 0 0 0 0 0 4 22	0 0 0 0 1 0 8 2 0 0 0 0	000000000000000000000000000000000000000	000000000000000000000000000000000000000	JFMAMJJASONUY
•		•	•						<u></u> .	P		SC(			AR			-'		'	'						''		_
1.5 1.3 2.4 2.8 1.4 2.8 3.0 3.8 0.6 1.0 2.2 2.4 2.1	3. 4. 5. 5. 5. 5. 5. 5. 5. 5. 5. 5. 5. 5. 5.	12. 10. 11. 12. 12. 13. 14. 15. 16. 17. 17. 17. 17. 17. 17. 17. 17. 17. 17	2 2 2 9 1 0 3 7 2 2 0 2 3 3 3 4 4 1 4 2 3 2 9 2	239772664101855	2, 603 8, 730 6, 731 5, 169 6, 366 5, 011 4, 012 4, 473 2, 775 3, 965 51, 293	5 24 9 29 3 32 3 35 3 36 3 36 3 36 3 36 3 36 3 36 3 36	S. S. S. S. S. E. S. S. S. S.	25 6 9 2 3 0 1 5 3 8 11 7	17 10 0 12 3 0 18	4 11 5 3 0 2 1 5 2 2 5 2 2 3 3 3 3 3 3 3 3 3 3 3 3 3 3	2 2 3 8 2 5 2 3 4 2	11 20 27 51 40 50 48 38 39 23 28	6 8 4 5 8 7 10 5 11 11 9 24 108	1 3 4 1 0 0 1 2 4 2 5 4	3 15 3 4 2 0 1 3 0 2 5 2	38 28 31 15 32 26 28 30 26 39 25	0. 4 1. 4 0. 6 0. 3 0. 0 2. 5 1. 2 0. 1 0. 3 2. 4	8 0. 6 0. 7 0. 2 0. 7 0. 3 2. 4 0. 8 0. 6 1. 2 0.	32 70 34 29 05 25 44 11 30 50 20	21 20 14 15 20 17 16 11 27 28 20 20 229	8 6 11 15 11 10 12 19 3 2 8 8 113	3		0000	28 24 14 3 0 0 0 1 17 26 113	0 13 7 0 0 0	1 0	000000000000000000000000000000000000000	JEMAMIJASONDY
							·	<b>'</b>	<u> </u>	R		BI (=3			CA =39			_!_				<u>'                                    </u>	1		'				
5, 4 2, 3 4, 5 2, 6 1, 2 0, 4 1, 4 5, 0 2, 7	5, 1 4, 7 2, 6 2, 4 2, 0 1, 2, 5 8, 1 9 3, 3	3.3.0.3.2.3.1.0.0.2.6.5.2.	4 4 4 4 4 2 3 3 7 6 4 5 0 5 7 5 0 5 7 5 6 5 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5 6 7 5	1.65	4, 776 4, 86 3, 196 4, 08 3, 07 6, 28	3 22 8 28 4 30 8 28 9 24 0 24 7 28 6 44 1 24 2 2: 6 44 4	S., N. S. NW. S. NW. S. NW. S.	50 40 37 24 14 19 22 24 21 38 313	1 3 1 3 4 3	6 4 9 5 6 1 5	4 7 16 4 6 3 4 5	12 14 32 35 37 32 46 36 21 22 34	1 2 3 3 5 2	3 1 1 1 4 2 7 7 1	19 20 15 16 24 21 10 13 28 23 20 6 215	5 3 4 4 1 4 4 3 5 3 5	1. 1 0. 6 0. 6 1. 3 0. 6 2. 6 0. 1 17. 6	6 1.	22 58 71 05 00 91 06 73 83	12 14 22 8 22 20 28 30 27 22 5 13 223	13 10 8 18 8 7 3 1 3 8 10 7 96	1 4 1 3  1 15 11	9 6 2 5 1 1 3 21 9			5 7 19 28 13 5	2	•	J FM AM J J A SONDY
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## ROCHESTER, N. Y.

[Latitude, 43° 8' N.; longitude, 77° 42' W. Local time, 0.11, slow, Eastern.]

	Pr	essure	•			Te	mper	atu	re.			:	Dew 1	point.			Rela		
Months and year.	Меап.	Maximum.	Mininum.	7 a. m.	8 p. m.	11 р. ш.	Mean.	Maximum.	Minimum.	Maximum.	Minimum.	7 A. III.	3 р. ш.	11 р. ш.	Mean.	7 a. m.	8 p. m.	11 p. m.	Mean.
J F M J J S O D	In. 29. 348 29. 278 29. 331 29. 357 29. 278 29. 819 29. 395 29. 379 20. 244 29. 244 29. 242 29. 313	In. 29. 97 29. 78 29. 73 29. 85 29. 61 29. 64 29. 68 29. 66 29. 67 30. 03 30. 03	28. 51 28. 46 28. 75 28. 80 28. 84 29. 02 28. 84 28. 84 28. 84 28. 45 28. 45	19. 1 10. 2 17. 1 38. 2 51. 1 58. 3 65. 3 60. 3 54. 0 44. 2 38. 3 27. 6 40. 3	23. 1 17. 2 23. 1 46. 4 60. 5 69. 3 75. 4 68. 7 65. 1 52. 6 43. 2 81. 1 48. 0	0 19.5 13.6 19.7 39.5 54.5 61.6 68.0 62.3 57.6 46.5 40.0 29.2 42.7		90	-5 -11 -7 20 31 41 49 44 40 28 24 4	29. 3 23. 9 29. 1 52. 5 66. 9 76. 5 81. 3 73. 9 71. 2 58. 4 48. 8 38. 3 54. 2	0 13.5 5.1 13.0 33.1 46.9 52.7 60.7 56.6 50.0 41.7 35.0 23.1 36.0	0 14. 2 5. 9 12. 4 32. 1 45. 6 53. 2 60. 8 57. 0 41. 6 34. 2 23. 5 35. 9	0 15.1 11.3 16.4 84.0 48.8 57.3 64.2 59.1 54.8 45.7 36.5 26.6 39.2	0 14.3 8.8 15.4 82.9 47.6 55.3 62.4 58.0 52.9 43.1 36.2 25.5 37.6	0 14. 5 8. 5 14. 7 31. 0 47. 3 55. 8 62. 5 58. 0 52. 5 43. 5 35. 6 25. 2 87. 6	81 82 79 82 83 86 89 87 91 86 85 85	72 78 75 65 67 69 72 71 78 83 73	80 79 83 78 78 80 83 86 88 86 86 88	788 £74 757 81 81 85 85 86
!		T.atitr	ide, 43	9 13/ 7	V . 10		OSEI					me 8	13 alc	w E	esterr		!		_
J F M. A J J S O N	29. 573 29. 604 29. 599 29. 478 29. 439 29. 487 29. 454 29. 452 29. 452 29. 452	29, 86 29, 88 30, 03 29, 80 29, 66 29, 69 29, 61 29, 65 29, 72 29, 87	29, 19 29, 23 29, 27 29, 10 29, 21 29, 23 29, 22 29, 26 29, 13 29, 23	40. 1 44. 5 42. 2 42. 2 48. 8 50. 9 55. 1 53. 7 51. 1 46. 9	45. 6 50. 5 55. 8 59. 7 64. 9 65. 3 75. 2 72. 5 70. 5 64. 0	44. 4 49. 0 54. 5 56. 6 61. 2 61. 8 71. 5 70. 6 65. 2 58. 1	43. 4 48. 0 50. 8 53. 0 58. 3 59. 2 67. 3 65. 6 62. 3 56. 3	66 67 75 82 89 85 101 92 90 91	27 29 29 31 39 46 46 38 33	51, 9 55, 6 65, 7 68, 0 71, 6 71, 1 83, 0 82, 2 78, 0 72, 0	37. 6 42. 3 39. 9 40. 5 47. 2 49. 8 53. 0 51. 6 49. 0 44. 0	38. 2 42. 0 40. 0 40. 5 46. 1 47. 8 51. 2 49. 7 48. 8 44. 8	39. 1 41. 7 42. 4 41. 8 46. 7 47. 0 50. 6 50. 8 49. 1 47. 4	40. 2 43. 6 44. 3 41. 5 46. 6 48. 8 51. 4 52. 7 51. 4 48. 7	39. 2 42. 4 42. 2 41. 3 46. 5 51. 1 49. 6 47. 0	93 91 92 92 91 89 87 87 90 93	79 74 62 53 53 43 48 48 57	86 82 70 60 61 51 54 62 72	86 82 75 68 68 69 60 67 74
	(	Latitu	de, 88°	35/ N	7. ; lo		CRAI le, 12					me, 8.0	X6, alo	w, Es	stern	.]			
J F M M J S O N D	80. 114 80. 065 80. 015 29. 896 29. 839 29. 847 29. 782 29. 809 29. 897 29. 925 80. 094 29. 932	80. 36 80. 36 80. 32 30. 15 29. 99 80. 07 529. 93 29. 93 29. 92 80. 08 30. 22 30. 36	29. 80 29. 79 29. 75 29. 47 29. 68 29. 65 29. 69 29. 63 29. 41 29. 72 29. 41	44. 5 49. 0 52. 5 53. 9 56. 5 57. 1 61. 1 61. 8 58. 0 54. 1 50. 8 47. 1 53. 9	48. 4 57. 1 64. 1 66. 3 73. 8 74. 6 79. 9 83. 3 80. 2 73. 6 58. 0 50. 5 67. 5	48. 4 55. 8 60. 8 61. 6 66. 7 66. 9 72. 1 73. 9 71. 8 65. 1 54. 5 49. 6 62. 2	47. 1 54. 0 59. 1 60. 6 65. 7 66. 2 71. 0 69. 8 64. 3 54. 4 49. 1 61. 2	62 70 77 83 98 91 98 105 98 77 65 105	34 40 46 89 49 51 56 51 50 40 88 88	52. 7 62. 5 70. 5 71. 3 79. 8 79. 9 86. 2 91. 9 88. 2 79. 9 61. 6 53. 8 73. 2	42. 0 46. 4 50. 2 51. 5 54. 8 55. 9 59. 8 56. 3 51. 4 48. 2 45. 0 51. 8	42. 5 44. 0 45. 3 48. 9 47. 8 49. 5 51. 4 50. 9 47. 7 47. 7 45. 8 47. 5	43. 9 45. 5 45. 6 51. 1 49. 9 50. 5 54. 1 54. 5 49. 5 49. 7 46. 4 49. 2	44. 7 46. 1 48. 2 51. 4 50. 9 51. 1 53. 3 54. 5 49. 9 50. 1 50. 3 46. 8 49. 8	43. 7 45. 2 46. 4 50. 5 49. 5 50. 4 52. 9 53. 3 49. 4 49. 1 49. 2 46. 2 48. 8	92 83 77 84 74 76 71 69 73 81 90 94 80	85 67 53 59 44 42 88 36 45 76 87	87 71 65 70 58 57 53 52 49 61 86 90 67	88 74 65 71 59 55 53 63 63 84 90 68
		[Latite	ade, 88	o 38/ :	N.; lo		ALN'I ide, 90					ne, 1.0	1, alo	w, Ea	stern.	.]			
J F M.A M.J J S O N	29, 570 29, 437 20, 508 20, 399 29, 338 29, 430 29, 392 29, 487 29, 487 29, 430	30, 08 29, 92 29, 87 29, 78 29, 58 29, 66 29, 65 29, 66 29, 70 20, 70 20, 06	28, 77 28, 90 29, 11 28, 96 28, 97 29, 10 29, 20 29, 01 29, 00 28, 92 28, 73 28, 73	21, 5 23, 4 35, 7 51, 7 59, 1 68, 2 74, 9 69, 1 63, 1 50, 5 43, 9 34, 6 40, 6	29. 7 31, 2 46, 3 62, 0 70, 5, 79, 7 86, 8 80, 3 73, 9 61, 9 51, 8 43, 5 50, 8	26. 7 26. 5 41. 2 55. 6 65. 1 72. 6 79. 7 74. 3 68. 2 55. 0 47. 7 38. 6 54. 3	26. 0 27. 0 41. 1 56. 4 64. 9 73. 5 80. 5 74. 6 68. 4 47. 8 38. 9 54. 6	69 68 74 79 91 92 97 95 84 70 76 65 97	-10 -5 13 32 40 52 60 53 50 37 32 6	36. 1 36. 2 50. 4 65. 7 73. 4 82, 5 89. 3 83. 7 76. 3 64. 8 56. 2 47. 8	16. 7 16. 7 32. 5 48. 2 57. 5 66. 6 74. 1 62. 0 48. 5 40. 4 30. 3 46. 8	15. 5 16. 9 28. 1 42. 8 51. 6 62. 2 70. 3 64. 6 58. 4 44. 4 47. 7 28. 2 43. 4	20, 8 20, 7 30, 1 45, 6 52, 0 65, 5 71, 3 65, 8 58, 9 46, 4 39, 9 30, 3 45, 6	19. 3 19. 6 29. 3 45. 1 54. 3 66. 0 72. 5 66. 9 60. 6 46. 6 38. 6 29. 0 45. 6	18. 4 19. 1 29. 2 44. 5 52. 6 64. 6 71. 4 65. 8 59. 3 45. 8 38. 7 29, 2 44. 9	78 76 74 73 77 82 86 86 85 80 79 78 70	69 66 55 58 54 63 61 63 61 59 66 81 61	74 76 63 70 69 79 78 77 74 72 69 73	74 72 64 67 67 74 76 77 77 77 77 77 77 77 77 77 77 77 77

## Monthly and yearly meteorological summaries—Continued. ROCHESTER, N. Y.

		1	H = 621.	h = 145.]			
Cloudiness (in tenths).		Wind.			Precipi- tation.	Numbe	or of days—
7 a. m 8 p. m	Total (miles.) Maximum.	North.  Northeast. East.	Southeast. South.	West. Northwest.	Total. Max. 24 hours.	Clear. Fair. Cloudy.	Mar. below 320. Mar. below 320. Mar. abore 320. Mar. abore 320. Thunder-etorns. Auroras. Months and years.
8.0 8.0 6.5 7.5 7.0 8.0 6.0 77.5 5.76.5 5.8 75.8 6.2 7.5 1.8 94.8 5.8 5.4 4.8 75.6 7.2 7.2 5.5 6.6 9.0 8.8 7.2 8.3 8.7 8.0 8.6 8.6 8.7 8.7 8.0 8.6	9, 157-45 8, 590-38 7, 300-34 8, 593-37 8, 593-37 8, 825-32 8, 893-37 6, 755-28 8, V 1, 149-40 9, 430-38 W. 1	7.   2   3   1   7.   6   9   8   2   7   1   8   10   2   2   1   8   10   2   2   1   8   10   2   2   1   8   10   2   2   1   1   1   1   1   1   1   1	17 4 13 4 8 19 5 6 18 3 14 11 15 2 6 28 7 5 26 11 7 17 5 6 10 23 8 9 21 8 13 21 8 8 23	30 20 2 15 20 3 15 6 8 28 14 4 16 13 6 13 14 8 14 10 4 13 9 6 20 5 4 28 13 0	0. 96 0. 18 2. 96 1. 48 2. 02 0. 53 4. 27 1. 67 2. 74 1. 29 2. 20 0. 65 2. 49 0. 84 2. 66 0. 72 2. 10 0. 51	9 12 9 6 17 8 1 4 12 15 1 9 15 6 1 7 10 14 1 0 10 20 1 0 10 21 1	21 18 28 0 0 0 0 J. 11 120 28 0 0 1 1 M. 11 12 18 29 0 0 1 1 M. 13 0 1 0 2 0 0 M. 13 0 1 0 2 0 0 M. 10 0 0 0 4 0 J. 10 0 0 0 4 0 J. 10 0 0 0 1 0 0 J. 10 0 0 0 0 1 0 J. 10 0 0 0 0 1 0 J. 11 0 0 0 0 1 0 J. 12 0 0 0 0 0 J. 13 0 0 0 0 0 J. 14 0 0 0 0 J. 15 0 14 0 0 0 J.
8. 5 1. 8 a. 6 a. 6	7, 300	!!	OSEBURG	OREG.	22.51	30 132 130 11	19711 010 011
5. 9 7. 5 7. 6 7. 0	1, 137	5 9 7	H = 523.	h = 46. J	2. 99 1. 07	3 12 16 1	16 0 5 0 0 0 J.
7. 88. 11. 7. 5. 7. 8 3. 14. 9. 2. 5. 3. 5 3. 94. 3. 2. 5. 5. 5. 5 6. 4. 6. 7. 6. 7. 6. 6 2. 8. 2. 8. 2. 42. 7 0. 90. 80. 80. 80. 80. 8 3. 5. 3. 4. 2. 5. 3. 1 3. 0. 4. 3. 3. 4. 6. 9. 6. 7	1, 323 14 SE 1, 219 13 SV 1, 885 20 SV 2, 160 16 SV 2, 273 15 N 2, 504 24 N 1, 822 15 N 1, 510 16 SV 885 12 N V	SW. 4 6 7 9 7 5 4 5 4 5 4 5 4 5 5 4 5 5 6 5 6 5 6 6 5 6 6 6 6	4 19 10 2 0 4 5 1 0 3 4 3 0 7 9 2 1 0 1 0 2 0 1 7 1 7 8 1 2 2	3 8 28 7 13 46 6 12 32 7 12 22 10 18 12 9 19 20 10 13 41 14 16 41 15 3 60	5. 28 1. 09 0. 28 0. 16 1. 21 0. 62 2. 91 0. 76 1. 53 0. 69 0. 07 0. 07 0. 36 0. 14	2 8 18 2 12 16 3 13 13 4 11 8 12 1 3 13 14 18 12 1 26 4 1 10 11 3 14 12 5	16 0 5 0 0 0 0 J. 21 0 3 0 9 0 F. 21 0 1 0 0 0 M. 7 0 1 0 1 0 1 0 A. 12 0 0 0 0 1 0 J. 7 0 0 0 0 1 0 J. 1 0 0 6 2 0 J. 0 0 0 0 0 0 S. 5 0 0 1 0 0 0 S. 5 0 0 1 0 0 0 0.
<del></del>	<u></u>	SA	CRAMEN	TO, CAI	<u> </u>		_!_!
5, 2 0, 0 4, 5 5, 2 2, 5 3, 4 2, 3 2, 7 2, 5 3, 2 2, 6 2, 8 3, 2 4, 4 2, 47, 3, 5 1, 0 1, 9 0, 5 1, 1 4 1, 7 1, 0, 6 0, 8 0, 2 0, 1 0, 7 0, 5 0, 8 1, 5 0, 8 1, 6 1, 8 3, 2 2, 1 2, 4 5, 5 6, 2 5, 3 5, 7 2, 5 3, 4 2, 5 2, 8	4, 851 31 NV 5, 312 24 NV 5, 009 23 S 6, 289 30 N 6, 716 24 S 6, 716 24 S 6, 164 18 S 5, 164 18 S 7, 161 18 S 7, 985 36 S 4, 458 25 N	W. 8 3 N. 16 0 9 3 W. 1 0 S. 9 3 W. 5 0 S. 0 1 V. 5 0 V. 5 0 V. 5 0 V. 5 0 V. 5 0 V. 1 0 V. 1 3 V. 1 3 V. 1 0 V. 1 0	4 26 13 4 1 12 10 10 2 12 18 25 11 24 26 11 12 24 37 10 19 27 31 12 24 37 11 18 26 19 2 1 16 22 36 16 16 5 14 40 7 5	5 22 1 2 37 1 2 17 1 4 10 5 2 13 3 4 4 4 6 0 10 1 2 9 1 1 20 3 5 27 1 1 18 1 1 27 2	0, 49 0 28 0, 08 0, 07 0, 08 0, 51 0, 11 0, 10 0, 00 0, 00 0, 08 0, 08	11 7 13	8 0 0 0 0 0 0 J. 6 0 0 0 0 0 F. 2 0 0 0 0 0 M. 7 0 0 0 3 0 A. 0 0 0 4 0 0 M. 2 0 0 0 0 0 J. 0 0 0 0 0 J. 1 0 0 0 0 J. 1 0 0 0 J. 2 0 0 J. 3 0 J. 3 0 J. 5 0
		S.	AINT LOUGH LOUGH $H = 571$ .	JIS, MO. $h = 99$ ].			
4. 3 5. 4 3. 9 4. 5 4. 9 5. 4 3. 2 4. 5 6. 1 6. 5 5. 3 6. 6 5. 2 6. 9 4. 1 5. 7 6. 2 6. 9 4. 1 5. 7 4. 5 5. 5 3. 1 6. 6 7. 4. 4 2. 2 3. 8 4. 6 5. 4 4. 2 4. 7 4. 8 6. 1 4. 4 5. 7 4. 8 5. 6 3. 8 4. 7 4. 8 5. 6 3. 8 4. 7	5 6, 338 28 N V 9 9, 878 42 W 9 9, 339 36 N W. 7, 628 34 N V 6, 995 28 S V 119 22 S V 6, 730 44 W 8, 040 34 W 9, 905 41 S 19, 905 60 K	W. 11 9 7 7 18 11 19 17 7 18 11 11 11 11 11 11 11 11 11 11 11 11	5 17 13 12 5 9 11 4 2 0 15 13 8 19 15 7 8 19 15 7 9 15 20 7 4 8 20 20 7 7 15 10 4 23 10 11 5 13 13 12 8 24 9 0 158 182 142	19 13 1 14 14 (6 9 10 1 12 15 1 9 7 1 9 5 (6 8 5 4 5 1 14 14 (6 18 16 (6 18 16 (6 18 16 (6) 18 16	0, 87 0, 41 0, 40 0, 14 4, 84 1, 41 2, 80 0, 85 7, 68 3, 12 2, 58 0, 99 2, 96 1, 14 8, 98 3, 47 7, 51 3, 14 1, 68 0, 84 2, 03 0, 71	10 12 6 13 13 5 7 11 12 7 17 7 3 20 6 8 21 2 12 15 4 13 7 10 12 12 7 10 20 10 11 12 8	12 13 23 0 0 0 J. 7 12 22 0 1 0 F. 5 2 12 0 0 0 M. 14 0 0 0 2 0 A. 11 0 0 1 3 0 M. 12 0 0 3 7 0 J. 10 0 0 18 8 0 J. 11 0 0 0 0 5 5 0 A. 11 0 0 0 0 3 0 S. 11 0 0 0 0 3 0 S. 11 0 0 0 0 0 0 0 V. 7 0 1 0 1 0 N. 9 3 15 0 0 0 D. 19 30 73 27 32 0 Y.

## SAINT MICHAEL'S, ALASKA.

[Latitude, 63° 28' N.; longitude, 161° 48' W. Local time, 5.39 slow, Eastern.]

	Pr	068UF0	•			Te	mper	atuı	re.	_		1	Dew I	oint.		þ	Rela umi	dit	<b>5</b> 7.
year.										Me	an.					1			•
Months and	Mean.	Maximum.	Minimum.	7 a. m.	3 p. m.	11 р. m.	Mean.	Maximum.	Minimum.	Maximum.	Minimum.	7 a. m.	8 p. m.	11 р. т.	Meen.	7 a. m.	8 р. ш.	11 p. 电	Mean.
J F M J 80 DV	In. 29, 742 29, 897 29, 904 29, 679 29, 801 20, 855 20, 902 29, 771 20, 610 29, 749	In. 80. 24 80. 72 80. 56 80. 60 80. 19 80. 21 20. 21 80. 25 80. 20 80. 20 80. 20 80. 72	In. 29. 12 29. 83 29. 14 28. 89 29. 30 29. 46 29. 31 89. 50 29. 26 28. 90 28. 67 28. 98 28. 67	-16. 1 6. 9 23. 7 32. 8 44. 6 49. 7 48. 6 43. 6	-16. 4 8. 9 25. 6 36. 9 47. 8 53. 1 51. 5 44. 2 82. 8	-15. 7 12. 0 26. 8 38. 8 49. 5 55. 5 53. 0 44. 7 38. 8	25. 4 36. 2 47. 3 52. 8 51. 0 44. 2 83. 0 8. 0 2. 3	11 43 41 56 63 69 65 69 45 81 85	-55 -36 4 10 31 40 87 27 20 -21 -43	0 19.0 -8.2 16.4 31.6 43.6 53.2 58.4 56.2 47.8 36.5 14.3 11.2 31.7	-26. 1 1. 2 18. 9 30. 0 42. 1 47. 1 45. 9 40. 2	-21. 0 2. 9 20. 4 80. 5 41. 1 47. 2 45. 3 39. 5 29. 8	41. 9 48. 0 45. 3 88. 7	-20. 8 7. 3 22. 3 82. 2 42. 7 48. 2 46. 5 89. 1 29. 9 5. 9	-20. 7 4. 8 21. 1 81. 4 41. 9 47. 8 43. 7 89. 1 29. 7 5. 8 -0. 9	78 83 87 91 88	87 82 81 81 81 80 83 80 82 87 89 85 83	86 78 81 83 79 77 79 81 87 80 85	8779 828 848 853 853 858 859 854

## SAINT PAUL, MINN.

[Latitude, 44° 58' N.; longitude, 93° 3' W. Local time, 1.12 slow, Eastern.]

J M M J J	29, 176 29, 085 29, 126 29, 070 29, 010 29, 082 29, 030 29, 088 29, 073	29. 58 29. 52 29. 40 29. 30 29. 41 29. 31 29. 48	28. 50 28. 63 28. 64 28. 64 28. 66 28. 74	3. 6 20. 6 39. 5 49. 7 60. 2 66. 6 59. 0	15. 3 82. 6 50. 6 63. 8 74. 4 79. 3 72. 3	10. 8 27. 9 45. 8 56. 6 66. 0 71. 6 63. 6	9. 9 27. 0 45. 3 56. 7 66. 9 72. 5 65. 0	49 55 75 87 89 95	-24 -6 20 27 36 55 46	24. 6 38. 5 57. 8 69. 8 79. 4 84. 1 75. 3	18. 3 37. 5 46. 9 57. 2	44. 4 57. 5 63. 8 55. 3	4. 9 21. 6 40. 5 48. 7 62. 8 68. 9 59. 2	1. 7 18. 9 39. 1 48. 5 61. 4 66. 9 58. 0	0. 8 18. 1 88. 0 47. 2 60. 6	67 75 82 83 91 91	74 65 65 70 68 71 64 57	79 69 70 78 74 85 85 82 78	77 72 81 82
O N D Y	29, 092 29, 064 29, 121 29, 086	29. 42 29. 68	28. 47	29. 9 17. 8	37. 7 25. 1	82. 2 20. 4	33. 3 21. 1	53 52	17 -18	39. 7 28. 8	18. 2	27. 6 13. 6	80. 4 17. 7	29. 8 16. 8	37. 4 29. 1 16. 0 84. 9	91 84			85 81

#### SAINT VINCENT, MINN.

[Latitude, 48° 56' N.; longitude, 97° 14' W. Local time, 1.29 slow, Eastern.]

J F M .	29, 183 29, 152 29, 230 29, 102	29. 60 29. 71 29. 53		-11. 5 10. 0 <b>29</b> . 9	2. 4 20. 7 43. 7	-3. 4 14. 7 36. 6	-4. 2 15. 1 36. 7	38 42 65	-39 -25 -14	6.1 25.9 47.2	-15. 6 2. 8 27. 0	-13. 6 7. 1 26. 7	-6.7 12.0 81.9	-6. 6 10. 5 81. 9	-9.0 9.9 30.2	90 87 87	65 68 65	86 83 83	84 80 79 79
M. J J A 8	29, 065 29, 112 29, 022 29, 111 29, 083	29. 46 29. 30 29. 50 29. 50	23. 54 28. 47 28. 76 28. 47	52. 2 57. 5 49. 8 43. 2	66. 8 71. 0 68. 8 65. 4	57. 4 61. 8 56. 3 50. 7	58. 8 63. 4 58. 3 53. 1	84 91 86 82	32 39 27 24	71.0 74.4 71.4	40. 4 47. 9 54. 2 47. 1 40. 2	49. 9 55. 9 47. 8 40. 5	44. 1 56. 8 63. 1 57. 5 51. 9	53. 8 59. 2 53. 6 46. 2	53. 5 59. 4 53. 0 46. 2	92 94 93 90	71 77 68 63	91	76 84 87 84 79
O D Y	29, 110 29, 137 29, 116 29, 115	29.50 29.66	28. 78	24. 6 7. 5	32. 1 16. 3	26. 2	27.6 11.6	40 39	-21	51. 2 33. 1 21. 7 44. 6	20. 3 -0. 2	22. 0	38. 5 24. 9 8. 9 81. 1	22.8 7.9	23. 2 7. 4	89 91	74 72	81 86 87	79 83

## SALT LAKE CITY, UTAH.

## [Latitude, 40° 46' N.; longitude, 111° 54' W. Local time, 2.27 slow, Eastern.]

5, 654	26, 03	25 31	33, 1			28. 0 50	- 5	34.9	20 4	12.3	18.1	12.6	14 7	80	84	sol	-
5, 730				39. 9	10 E A												39
	26, 07	OF 426			00. 4	36. 1 51	22	42.6	31.0	25, 2			26.8				
541		20.41	37. 7	52, 1	44.8	44.9 70	24	54.6	36, 5	28.7	30. 2	31. 7	30. 2	70	44	61	20
F, 172 L	25, 85	25, 26	46.2	58. 6	52.0	52 3 72	34	62.3	44.7	37, 7	37.8	39.4	38.3	73	48	64	102
5, 572	25, 81	25, 32	49.8	63, 0	56. 2	56. 3 84	36	67. 2	46. 1	41.1	45, 2	43, 8	43, 4	73	53	65	61
5, 582	25, 76	25, 27	56.7	71.1	63, 7	63, 8 91	39	75. 8	53, 7	45, 3	49, 3	48.9	47. 8	67	48	60	5.9
623	25.77	25, 43	66. 8	84. 6	75. 6	75, 7 100	54	89, 3	62.9	52, 7	58. 8	54.5	55, 3	61	42	48	51
645	25, 79	35, 38	64, 9	82.5	72.5	73, 3 100	51	86, 9	60.5	52. 8	59, 3	54. 5	55, 5	60	46	55	56
618	25, 83	25, 29	56. 8	73.7	63.8	61.8 90	42	77.9	52. 3	43.9	46.9	45, 1	45, 3	64	41	50	53
703	25, 90	25.45	47. 8	64. 0	52.2	54.7 82	29	67. 9	41.9	25, 2	40.0	37.4	37. 5	63	43	288	55
639	26, 09	25.09	40.3	49.3	42.0	43.9 69	18			31. 9	35, 4	33, 3	33, 5	73	61	73	100
741	26. 13	25, 24	31.5	37. 7	32.8	34. 0 57	5	41.1	26. 7	25, 4	28. 2	26, 2	26.6	78	600	77	75
648	26. 13	25.09	46. 3	59. 1	51. 5	52, 3 100	5	62. 8	42, 6	36, 0	39.8	37. 9	37. 9	68	51	62	60
-		- 1			1	1					1	-	- 1	- 1			-
5	572 582 623 645 618 703 639 741	, 572 25. 81 , 582 25. 76 , 623 25. 77 , 645 25. 79 , 618 25. 83 , 703 25. 90 , 639 26. 09 , 741 26. 13	, 572 25, 81 25, 32 , 582 25, 76 25, 27 , 623 25, 77 25, 36 , 645 25, 79 35, 38 , 618 25, 83 25, 29 , 703 25, 90 25, 45 , 639 26, 60 25, 69 , 741 26, 13 25, 24	, 572   25, 81   25, 32   49, 8 , 582   25, 76   25, 27   50, 7 , 623   25, 77   25, 43   66, 8 , 645   25, 79   35, 38   64, 9 , 618   25, 83   25, 29   56, 8 , 703   25, 90   25, 50   40, 3 , 741   26, 19   25, 24   31, 5	, 572   25. 81   25. 32   49. 8   63. 0   582   25. 76   25. 27   56. 7   71. 1   623   25. 77   25. 38   64. 9   82. 5   645   25. 79   35. 38   64. 9   82. 5   618   25. 83   25. 29   56. 8   73. 7   703   25. 99   25. 45   47. 8   64. 0   639   25. 99   25. 45   49. 3   49. 3   741   26. 13   25. 24   31. 5   37. 7	, 572 25. 81 25. 32 40. 8 68. 0 56. 2 582 25. 76 25. 77 51. 1 63. 7 71. 1 63. 7 6. 23 25. 77 25. 43 66. 8 84. 6 75. 6 645 25. 79 35. 38 64. 9 82. 5 72. 5 618 25. 83 25. 92. 65. 8 73. 7 63. 8 ,708 25. 90 25. 43 47. 8 64. 0 52. 2 63. 2 50. 2 50. 4 63. 4 64. 0 52. 2 67. 1 26. 1 1 25. 2 1 25. 2 1 25. 2 1 25. 2 1 25. 2 1 25. 2 1 25. 2 1 25. 2 1 25. 2 1 25. 2 1 25. 2 1 25. 2 1 25. 2 1 25. 2 1 25. 2 1 25. 2 1 25. 2 1 25. 2 1 25. 2 1 25. 2 1 25. 2 1 25. 2 1 25. 2 1 25. 2 1 25. 2 1 25. 2 1 25. 2 1 25. 2 1 25. 2 1 25. 2 1 25. 2 1 25. 2 1 25. 2 1 25. 2 1 25. 2 1 25. 2 1 25. 2 1 25. 2 1 25. 2 1 25. 2 1 25. 2 1 25. 2 1 25. 2 1 25. 2 1 25. 2 1 25. 2 1 25. 2 1 25. 2 1 25. 2 1 25. 2 1 25. 2 1 25. 2 1 25. 2 1 25. 2 1 25. 2 1 25. 2 1 25. 2 1 25. 2 1 25. 2 1 25. 2 1 25. 2 1 25. 2 1 25. 2 1 25. 2 1 25. 2 1 25. 2 1 25. 2 1 25. 2 1 25. 2 1 25. 2 1 25. 2 1 25. 2 1 25. 2 1 25. 2 1 25. 2 1 25. 2 1 25. 2 1 25. 2 1 25. 2 1 25. 2 1 25. 2 1 25. 2 1 25. 2 1 25. 2 1 25. 2 1 25. 2 1 25. 2 1 25. 2 1 25. 2 1 25. 2 1 25. 2 1 25. 2 1 25. 2 1 25. 2 1 25. 2 1 25. 2 1 25. 2 1 25. 2 1 25. 2 1 25. 2 1 25. 2 1 25. 2 1 25. 2 1 25. 2 1 25. 2 1 25. 2 1 25. 2 1 25. 2 1 25. 2 1 25. 2 1 25. 2 1 25. 2 1 25. 2 1 25. 2 1 25. 2 1 25. 2 1 25. 2 1 25. 2 1 25. 2 1 25. 2 1 25. 2 1 25. 2 1 25. 2 1 25. 2 1 25. 2 1 25. 2 1 25. 2 1 25. 2 1 25. 2 1 25. 2 1 25. 2 1 25. 2 1 25. 2 1 25. 2 1 25. 2 1 25. 2 1 25. 2 1 25. 2 1 25. 2 1 25. 2 1 25. 2 1 25. 2 1 25. 2 1 25. 2 1 25. 2 1 25. 2 1 25. 2 1 25. 2 1 25. 2 1 25. 2 1 25. 2 1 25. 2 1 25. 2 1 25. 2 1 25. 2 1 25. 2 1 25. 2 1 25. 2 1 25. 2 1 25. 2 1 25. 2 1 25. 2 1 25. 2 1 25. 2 1 25. 2 1 25. 2 1 25. 2 1 25. 2 1 25. 2 1 25. 2 1 25. 2 1 25. 2 1 25. 2 1 25. 2 1 25. 2 1 25. 2 1 25. 2 1 25. 2 1 25. 2 1 25. 2 1 25. 2 1 25. 2 1 25. 2 1 25. 2 1 25. 2 1 25. 2 1 25. 2 1 25. 2 1 25. 2 1 25. 2 1 25. 2 1 25. 2 1 25. 2 1 25. 2 1 25. 2 1 25. 2 1 25. 2 1 25. 2 1 25. 2 1 25. 2 1 25. 2 1 25. 2 1 25. 2 1 25. 2 1 25. 2 1 25. 2 1 25. 2 1 25. 2 1 25. 2 1 25. 2 1 25. 2 1 25. 2 1 25. 2 1 25. 2 1 25. 2 1 25. 2 1 25. 2 1 25. 2 1 25. 2 1 25. 2 1 25. 2 1	741 26. 13 25. 24 31. 5 37. 7 32. 8 34. 0 57	$ \begin{array}{cccccccccccccccccccccccccccccccccccc$									

## SAINT MICHAEL'S, ALASKA.

[H=30, h=2.]

		ud									W	nd.		(11:	=30.	. n	=2.	J	Prec			N	um\	ber	of d	aye			Ī	-
7 a. B.		8 p. m.	11 p. m.		Меап.		Total (miles).	Maximum.	Direction.	North.	Northeast.	East.	Southeast.	South.	Southwest.	West.	Northwest.	Calms.	Total.	Max. 24 hours.	Clear.	Fair.	Cloudy.	Rain or snow.	Max. below 32°.	Min. below 32°.	Max. above 90°.	Thunder storms.	1	Months and year.
8.6 7.8 7.8 8.1 5.5 5.5	35788888765	8 5 6 8 2 2 2 5 5	87.8887.765	384 584 589 043	173137733131313131313131313131313131313	12 7 7 8 10 10 10 8	, 29	1 36 1 48 9 50 3 46 1 38 3 44 3 6 5 64 5 56 1 56	E. S.	18 23 22 29 12 10 12 8 43 29 26 6 235	23 5 10 9 15 9 11 3 5 12 9 11 122	15 10 18 16 29 20 26	3 1 5 9 7 10 5 6 3 6 5 6 6		5 14 10 11 19 11 3 6 4 19	2 1 0 1 6 15 5 11 2 2 2 5 3	0 0 0 10 3 4 7 1 7 1 42	4 16 33 1 9 6 2 4 2 1 3 11 92	0. 88 0. 31 1. 07 0. 77 1. 04 3. 51 8. 06 4. 56 8. 39 1. 62 0. 47 0. 75 20. 93	0. 25 0. 14 0. 28 0. 80 0. 59 1. 21 1. 09 0. 94 0. 12 0. 15	11 3 1 2 1 3 7	13 8 7 9 7 5 9 5 15 10 9	7 12 22 19 22 24 21 22 13 13 12 191	7 8 9 16 13 19 21 22 19 12 12 14 172	28 15 12 2 0 0 0 4 30 27 146	28 27 28 13 1 0 5 26 30 31 220	00000000000	00000000000	2 3 1 1 0 0 4 2 6 2 2	F. M. J. S.O. D.
_								•		<u>'</u> '		S		T=8		UL,	 	IN: 3.]	N.			<u>'</u>							!_	
2665454	467.66 6 6 4 6 755	1 0 5 0 679	3.3.5.3.4 3. 3. 5.4.3. L32.4.4.4.3.4.2.4.6.3.	34009 3 8 0 9 238	1.00 3.22 3.55 5.3 3 9 0 800 4.32 4.32 4.32 4.33 5.55 5.55 7.48	10 10 10 10 10 10 10 10 10 10 10 10 10 1	, 424, 686, 644, 656, 600, 911, 49, 68, 50, 32, 50, 50, 50, 50, 50, 50, 50, 50, 50, 50	20 21 22 29 2 27 2 27 2 21 40 24 3 25 6 1 40 24 3 25 6 1 40 3 25 6 1 40 40 40 40 40 40 40 40 40 40 40 40 40	S. NW. N. NW. NW. N. NW. NW. W.	3 5 11 9 16 6 6 10 2 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8	1 3 4 8 8 2 4 4 1 1 2 3 0 3 9	6 2 0 0 0 3 177 144 166 666 SAI 1 1 1 0 5 5 5 5 5 5 5 5 4 4 5 5 3 3 4 2 2	100 77 99 88 77 166 8 288 77 66 133 1288 NTI 119 915 144 144 66 233 133 138	144 122 111 300 177 255 222 177 100 99 120 120 122 177 133 199 124 233 212	14 10 6 8 8 9 16 10 13 7 3 9 113 11NC 884 8 6 6 7 7 3 5 5 10 11 7 7 7 7 6 8 8 7 7 7 7 7 7 8 8 8 8 8 8 8	13 9 14 5 12 8 9 7 14 17 25 18 151 28 8 8 -3 6 6 16 15 14 13 0 9 134	25 24 34 15 12 11 11 21 20 22 9 11 203 T, =14 28 18 12 24 8 12 24 27 27 27 27 27	13 13 13 7 2 11 20 8 17 4 4 15 11 130 MI 1 0 0 0 0 0 0 1 1 1 1 1 1 1 1 1 1 1 1 1	0. 20 0. 55 3. 19 2. 12 3. 73 5. 86 3. 69 0. 60 0. 64 2. 55 3. 38 N 0. 10 0. 10 0. 20 0. 46 2. 85 1. 59 0. 93 1. 59 1.	1. 36 0. 86 1. 19 1. 36 1. 49 1. 52 0. 81 0. 35 0. 20 1. 52 0. 03 1. 12 0. 03 1. 12 0. 03 1. 02 0. 03 1. 03 0. 20 0. 20	12 8 4 6 8 7 12 11 10 3 9 102 102	15 178 10 10 18 11 16 15 17 18 10 11 10 16	3 7 10 6 7 7 6 12 17 6	6 5 11 12 7 7 12 13 11 6 6 7 7 11 11	73 29 26 20 2 1 0 0 0 0 0 9	31 28 31 16 7 0 0 1 1 3 23 20 31	2 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	33	0	J. A. S. O. N.D.Y. J. A. S. O. N.D.Y. J. A. S. O. N.D.Y.
											8	AL			KE 1,34		ΓY, h=7		ГАН.											
4. 0	2 2 2 5 4 4 5 5 3 4 4 5 6 4 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6		1444232288	7250834499	2. 1 5. 4 4. 7 3. 6 3. 9 3. 4 5. 1		2, 41 2, 37 2, 77 3, 00 2, 65 3, 92 3, 58 2, 82 3, 58 2, 80 2, 80	8 24 0 22 6 26 2 28 3 27 6 22 1 37 4 22 3 22 5 26 8 27	S. NW. SE. E. S. NW. SE. NW. NW.	4 4 19 6 11 18 23 16 13 12 9 6 141	8 6 8 4 11 14 14 2 7	160 7 60 8 8 9 8 9	10 10 10 20 19 24 26 15 40 24	12 6 9 3 11 13 15 7 8	3 5 3 4 1 1 5 1 0 4	9 7 5 8 4 3 6 15 5	14 18 12 21 11 13 8 14 16 9	18 11 28 31 14 0 0 4 6	1. 56 0. 64 3. 47 2. 49 2. 67 0. 58 0. 90 1. 29 0. 59 3. 10	0. 49 1. 01 1. 02 2. 00 0. 58 0. 30 0. 63 0. 51 0. 96 0. 32	20 7 10 19 12 13 15 15 7	10 10 14 17 17 18 13 14 14			1	6 0 0 0 0 2 12 24	0 0 0	0 0 0 1 4 3 2 12 3 0 0 28	0000000	F. M. M. J. J. S.

SAN ANTONIO, TEX.
[Latitude, 29° 27' N.; longitude, 98° 28' W. Local time, 1.34 slow, Eastern.]

$\neg$	D-	CESUIC	uue, za	- ar-	A., j II		mpers			. 10	ont til	me, L.	Dem 1			1 :	Rela	ativ	-
ij			- 			1 40	- Poly	l	·				-04 I		1	- h	umi	idit	<i>y.</i>
d yes										Me	an.								
Months and year.	Mean.	Maximum.	Minimum.	7 a. m.	3 p. m.	11 p. m.	Mean.	Maximum.	Minimum.	Maximum.	Minimum.	7 a. m.	8 p. m.	11 p. m.	Mean.	7 A. ID.	8 p. m.	11 p.m.	Meen.
	In.	In.	In.	•	•	•	۰	•	•	0	•	•	•	•	۰				
J M M J S O D Y	29. 308 29. 135 29. 092 29. 166 29. 165 29. 142 29. 230 29. 237 29. 326	29. 60 29. 42 29. 30 29. 28 29. 26 29. 27 29. 28 29. 53 29. 53 29. 65	29. 03 28. 89 28. 81 28. 99 29. 04 29. 00 28. 97 28. 72 28. 69	53. 3 62. 9 65. 1 72. 8 72. 9 70. 7 57. 3 52. 1 47. 6	65. 8 75. 1 76. 7 87. 9 86. 6 90. 9 84. 9 76. 9 71. 3 63. 4	59. 1 68. 4 70. 4 79. 0 78. 7 80. 8 75. 5 64. 9 58. 8 53. 6	79. 4 81. 5 77. 0 66. 4 60. 7	95 95	36 52 51 60 65 66 59 41 84 26	68. 8 79. 4 80. 2 91. 4 89. 8 94. 2 88. 7 79. 1 74. 0 66. 3	62. 7 71. 1	48, 2 58, 1 62, 3 70, 9 71, 1 68, 1 52, 6 45, 4 42, 8	50. 6 58. 5 63. 0 67. 0 68. 9 65. 7 66. 9 52. 0 43. 0	50. 5 61. 1 63. 5 69. 4 69. 9 67. 6 67. 7 53. 2 46. 4 44. 2	59. 2 62. 9 69. 1 70. 0 67. 8 67. 6	84 86 91 94 91 92 85 79 84	62 60 64 50 57 44 57 44 40 53	74 79 80 73 75 65 78 67 66 73	73 75 78 78 78 67 75 66 62 70
		Latit	ıde, 82	9 43/ ]	V.: lo		AN 1					ime, 2	.48 alo	w. E	asterr	1.1			
J	80. 038	80. 28	29. 76	48.3	61. 5	52. 2	54. 0	68	38	62. 6	45. 4	42. 8	48. 4	47. 1	46.1	82	64	83	76
F M J 8 O D Y	29, 978 29, 986 29, 923 29, 855 29, 823 29, 823 29, 899 29, 866 29, 937 29, 998 29, 918	30. 22 30. 19 30. 10 29. 98 30. 05 30. 02 29. 94 29. 93 30. 01 30. 11 30. 18 30. 28	29. 75 29. 82 29. 74 29. 80 29. 75 29. 79 29. 77 29. 79 29. 67 29. 79 29. 67	49. 3 54. 0 56. 7 59. 0 59. 6 63. 3 67. 5 63. 6 59. 4 54. 5 51. 5 57. 2	62. 8 66. 5 68. 3 64. 9 70. 2 73. 1 77. 1 73. 8 69. 8 66. 4 65. 3 68. 6	54. 1 58. 3 61. 1 62. 1 63. 2 66. 4 70. 8 60. 5 52. 5 54. 5 60. 8	55. 4 59. 6 62. 0 63. 3 64. 3 67. 6 71. 8 68. 0 63. 9 59. 6 57. 1 62. 2 A N D ade, 8	76 81 83 73 74 82 89 89 89 76 79 89	89 42 47 52 52 58 82 56 47 41 40 38	64. 1 68. 0 69. 7 70. 0 70. 9 74. 5 78. 6 75. 1 71. 2 67. 4 66. 0 69. 8 OHIC	45. 9 51. 4 53. 2 58. 2 58. 3 62. 6 66. 6 61. 7 57. 0 52. 0 48. 6 55. 2	44. 3 47. 4 51. 9 54. 6 58. 6 60. 0 57. 5 51. 5 45. 0 52. 6	51. 1 51. 7 54. 9 56. 9 56. 8 59. 6 64. 1 62. 4 59. 4 54. 1 55. 6	48. 5 50. 8 54. 4 56. 3 56. 3 63. 9 61. 9 59. 6 54. 2 49. 4 55. 1	48. 0 50. 0 53. 7 55. 8 55. 7 59. 2 63. 5 61. 4 58. 3 47. 5 54. 4	84 80 84 84 84 88 84 89 94 90 80 85	67 61 63 66 62 63 65 68 70 68 57 64	82 78 79 82 79 78 86 90 88 88 88 75 75 75	78 73 76 77 75 76 81 85 82 73
M. M. J. J. O. D. Y.	29, 374 29, 353 29, 258 29, 352 29, 302 29, 378 29, 305 29, 279 29, 346 29, 330	29. 73 29. 69 29. 56 29. 61 29. 53 29. 61 29. 64 29. 68 29. 72 80. 00 30. 00	28, 80 28, 78 28, 85 29, 04 28, 81 28, 87 28, 82 28, 90 28, 50	23. 6 41. 9 53. 3 63. 7 70. 6 64. 7 58. 1 46. 1 38. 7 29. 6	80. 4 48. 6 60. 8 72. 5 80. 0 71. 8 69. 6 56. 0 43. 8 84. 7 51. 3	27.0	27. 0 44. 9 56. 7 67. 0 67. 5 63. 4 50. 5 41. 2 81. 6 47. 0	54 84 85 96 92 91 84 79 70 59	- 3 24 35 46 53 49 43 82 25 zero -15	34. G 54. 0 65. 4 78. 2 83. 0 75. 8 72. 3 59. 1 46. 8 38. 4 55. 3	19. 8 87. 7 49. 0 57. 5 66. 4 60. 6 55. 0 43. 6 85. 5	17. 0 84. 3 45. 2 54. 8 61. 9 57. 6 50. 6 40. 8 82. 7 23. 3 86. 5	19. 7 85. 5 45. 0 55. 1 62. 9 59. 2 52. 1 42. 4 84. 2 26. 1 88. 5	19. 3 36. 2 45. 6 54. 9 63. 3 58. 5 53. 0 42. 5 38. 6 28. 9	18. 7 35. 3 45. 8 54. 9 62. 7 58. 4 51. 9 83. 5 24. 4 87. 7	75 75 75 74 75 78 77 82 79 79	65 63 60 56 57 66 56 62 70 71 64	78 74 71 72 72 77 78 76 75	72 73 71 71 68 74 68 74 75 75
		[Latit	ade, 40	)° 28′	N. ; l		NDY ade, 7			•		ne, 0.0	4 fast	, Eas	tern.]				
J	30. 090	30. 83	29. 32	29. 8	83. 0	30. 3	31. 0	63	7	39, 2	23, 5	23. 5	26. 1	23, 8	24.5	77	76	76	76
F	29. 962	}		28. 0	27. 8	24. 8	25. 2	53	1	32. 4	17.5	16. 9	19. 5	18.1	18, 2	77	$\eta$	76	ı
M	30. 028 30. 011 29. 939 29. 981 29. 961 80. 046 29. 997 29. 985 29. 985	30. 58 30. 26 30. 28 30. 20 30. 25 30. 38 30. 28	29. 47 29. 59 20. 41 29. 69 29. 67 29. 39 29. 16 29. 55 29. 19	68. 7 60. 9 52. 6 43. 7 34. 7	54. 5 59. 4 74. 4 80. 2 76. 8 70. 4 59. 2 49. 7 39. 8	52. 8 63. 8 70. 9 69. 9 62. 8 54. 0 45. 3 36. 9	54. 6 67. 1 73. 7 71. 8 64. 7 55. 3 46. 2 37. 0	90 97 90 85 75 72 60	7 28 41 53 58 55 46 36 30 16	83. 8 79. 7 73. 5 61. 8 52. 7 44. 4	48. 9 59. 4 67. 7 66. 5 58. 5 50. 0 41. 2	19. 5 85. 7 46. 1 54. 9 64. 6 63. 5 57. 2 50 0 88. 6 29. 3 41. 6	66. 4 64. 2 61. 2	65, 5 64, 5 58, 8 50, 4 39, 7	36.6 46.6 55.8 65.5 64.1 59.1 50.6	77 82 76 83 84 88	64 56 67 56 64 66 73 76 71 70 68	73 78 81 72 83 84 87 88 61 79	66 77 66 77 78 83 83 76

## Monthly and yearly meteorological summaries—Continued. SAN ANTONIO, TEX. $[H=781. \lambda=2.1]$

93 111

70 129 31

97 10 14

## Monthly and yearly meteorological summaries—Continued. SANFORD, FLA.

[Latitude, 28° 48' N.; longitude, 81° 23' W. Local time, 0.25 slow, Eastern.]

	Pr	essure.				Te	mper	atur	в.				Dow 1	oint.			Zels umi		
Months and year.	Mean.	Maximum.	Minimum.	7 a. m.	8 p. m.	11 р. т.	Mean.	Maximum.	Minimum.	Maximum.	Minimum.	7 a. m.	3 p. m.	11 р. т.	Mean.	7 a. m.	3 p. m.	11 p. m.	Mean.
J F M J J S O D Y	In. 30, 155 30, 045 30, 106 30, 056 29, 963 30, 050 29, 965 29, 950 30, 050 30, 053	30. 32 30. 42 80. 32 30. 14 30. 20 30. 22 30. 13 30. 10 30. 14 30. 28 30. 50	29. 82 29. 80 29. 74 29. 87 29. 84 29. 75 29. 75 29. 73 29. 89	66. 3 56. 7 50. 1	80. 2 80. 1 83. 1 85. 0 85. 1 84. 4 77. 2 71. 6 63. 4	58. 6 66. 7 70. 4 75. 2 75. 4 76. 5 75. 7 67. 8 59. 9 53. 4	73. 9 78. 4 79. 5 79. 7 78. 5 70. 4 62. 7 55. 6	81 88 91 93 95 95 95 94 90 86	88 43 52 61 68 70 68 48 35	71. 2 69. 4 73. 4 83. 1 85. 4 89. 7 91. 7 91. 6 89. 4 79. 5 73. 1 66. 0 80. 3	49. 3 53. 1 62. 2 66. 8 72. 3 72. 5 73. 4 72. 6 64. 3 53. 9 46. 6	50. 9 60. 4 60. 7 74. 1 74. 2 75. 1 74. 2 63. 4 52. 2 45. 0	46. 8 50. 4 57. 3 63. 0 72. 3 71. 6 72. 7 61. 7 53. 0 47. 6	50. 2 52. 1 60. 9 65. 7 73. 0 72. 7 73. 5 73. 9 63. 2 54. 9	48. 3 51. 1 59. 5 65. 1 73. 1 72. 8 73. 5 62. 8 63. 4 46. 4	83 84 83 85 91 88 92 97 97 96 86 83	64 52 50 47 59 72 66 66 70 60 53 58 60	81 79 81 86 94 92 91 94 86 84	72 71 70 77 86 82 83 87 74 74

## SAN FRANCISCO, CAL.

[Latitude, 37° 48' N.; longitude, 122° 26' W. Local time, 3.10 slow, Eastern.]

## SAN LUIS OBISPO, CAL.

[Latitude, 35° 18' N.; longitude, 120° 39' W. Local time, 3.03 alow, Eastern.]

						Course		1544.5			1241										
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	29.	722	29, 8	5 20	. 58	55, 3	73.	58.7	62, 5	97	46	76. 5	53.4	51.1	56, 3	53, 7	53. 7	87	57	84	7
	29.	670	29.8	29	. 54	53. 7	75. 7	58.8	62, 6	94	47	78. 9	52.8	51.2	58, 4	54.6	54.7	91	57	86	12
	29.	648	29.7	7 29	. 53	53, 1	77.1	58. 5	63. 2	102	47	79. 9	51. 2	48.4	58, 1	53.4	63, 3	83	54	85	B
	29.	647	29.7	8 29	. 50	52.1	74. (	59, 3	62.2	91	41	77.0	52, 1	48.7	55, 9	52.6	52.4	87	53	80	Βŧ
1	29.	691	29, 9	0 20	.40	49.1	64. (	56.4	56.8	81	37	66.7	49.4	47.0	54, 7	52, 4	51.4	90	73	87	1
0.0	29,	794	29, 9	8 29	. 57	48. 1	63. 8	55, 5	55.7	82	35	66. 1	47.3	43.6	50.6	49.3	47.8	84	64	81	В
					51.		Leev.	1:462	2.00		1000					.200		128	101	100	E

SANTA FÉ, N. MEX. [Latitude, 35° 41′ N.; longitude, 105° 57′ W. Local time, 2.04 slow, Eastern.]

## Monthly and yearly meteorological summaries - Continued. SANFORD, FLA.

H = 25.	h=85.]

									_	[H	=2	5. 7	h=8	5.]						_							
		din	888 18).				1	Win	d.							Prec			Nu	mł	er	of	day	r <b>s</b>	-		
7 a.m.	8 p.m.	11 p.m.	Mean.	Total (miles).	Maximum.	Direction.	North.	Northeast.	East.	Southeast.	South.	Southwest.	West.	Northwest.	Calms.	Total.	Max. 24 hours.	Clear.	Fair.	Cloudy.	Rain or snow.	Max. below 32°.	Min. below 82°.	Max. above 90°.	Thunder-storms.	Auroras.	Months and year.
6. 6. 6. 2. 2. 2. 2. 3. 4. 3. 4. 4. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1.	6.4 5.4 4.1 5.4 6.7 7 7 7 7 7 8 8 7 8 8 7 8 8 8 8 8 8 8 8	5. 8. 3. 2. 3. 4. 3. 2. 3. 4. 3. 2. 3. 4. 3. 2. 3. 4. 3. 2. 3. 4. 3. 2. 3. 4. 3. 2. 3. 4. 3. 2. 3. 4. 3. 3. 3. 3. 3. 3. 3. 3. 3. 3. 3. 3. 3.	5 4. 4 5 4. 4 5 4. 4 5 4. 7 5 4. 7 5 4. 7 5 4. 8 5 4. 8	4, 53 4, 49 4, 26 8, 92 2, 78 2, 97 3, 64 2, 92 5, 18	9 22 8 24 8 23 12 27 13 26 13 27 11 23 13 27 11 20 13 30 15 20 19 33	SWNW NWN. NE. NE.S. NE. SE.	22 20 29 13 11 11 2 9 15 23 16 27 198	22 13 14 22 16 12 9 7 22 19 6 10 172	2 5 14 9 11 13 7 9 4 6 5 89	7 6 6 11 18 10 8 14 14 6 6	10 9 7 8 8 20 16 19 5 4 6 9	10 8 4 12 13 22 21 5 13 4 4 124	7 17 10 7 4 11 8 9 13 18 13 126	7 5 6 5 2 3 5 4 10 19 19	D	8. 96 4. 60 1. 52 4. 99 5. 89 5. 52 6. 75 10. 73 7. 48 0. 29 1. 85	1. 35 1. 13 1. 20 1. 18 2. 76 6. 09 0. 10 0. 90	12	12 8 12 17 16 20 17 16	6	15 11 10 4 13 17 18 19 20 6 5 7	00000000	0 00000000000	0 0 2 6 11 23 22 15 1 0	0 1 2 9 11 7 8 7 1 0 1	0 00000000000	J. F. M. A. M. J. A. S. O. N. D. Y.
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4.0 0.0 0.4 5.5 6.4 6.1 7.2 5.6 5.8 5.8	5, 5 5, 5 4, 7 4, 2 3, 5 3, 5 6, 4 4, 8	2. 5. 4. 3. 4. 4. 3. 6. 3.	5. 3 3. 3 4. 7 6. 4	4, 31 5, 45 6, 83 8, 96 10, 06 8, 64 8, 77 6, 68 5, 05	66 28 77 26 16 32 13 32 19 32 10 32 14 30 13 28 17 24	W. W. NW. W. NW. W. W. W. W. W. SE.	23 5 7 3 1 0 0 0 4 7 19 69	9 6 1 0 0 0 2 2 7	7 1 1 3 0 0 0 0 0 0 1 3 4 20	12 16 6 1 0 0 0 0 7 26 20 88	3 2 2 2 2 2 1 0 1 1 1 1 3 1 5 4 3 5	5	6 21 22 28 52 54 42 30 32 31 8 4 330	15 13 17 20 11 9 2 1 11 15 11 23 148	1	1. 01 3. 17 0. 04 0. 19 0. 06  0. 11 0. 72	0. 15 0. 55 2. 02 0. 04 0. 10 0. 05 	10 7 12 7 10 5 15 9 4 18	13 12 10 14 13 16 13 20 10 18 14 4 157	4 11 9 6 7 8 6 5 4	11 6 4 11 1 2 1 0 1 2 2 21 1 10 70	0 0 0 0 0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	000000000000000000000000000000000000000	0	0 0 0 0	J. F. M. A. M. J. A. S. O. N. D. Y.
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8.0 8.6 3.5 2.1 4.9 2.7	D. C	ю.	7 8. 5 3 3. 6 3 1. 5 7 2. 6 9 4. 5 2 2. 5	y 0,01	1 44	SE.	5 12 15 19 18 38	1 1 4 5 6	0 0 1 1 2 3 0	1 5 5 6 7 14 5	 3 13 12 7 3 11 6	99436648	••••	 5 15 20 16 15 7 9	6 5 5 10 8 7	0.02	0. 02 0. 01 0. 01 0. 04 8. 86 1. 48	10 16 19 20 18 13 19	16 11 12 10 9 6 7	 4 4 0 0 4 11 5	20 00 00 22 17 6		000000000000000000000000000000000000000		000000000000000000000000000000000000000		J. F. M. A. M. J. J. A. S. O. N. D. Y.
										NT <i>H</i> =		FÉ, 26.		M: 29.		ζ.											
8.0 4.4 4.4 8.4 1.2 2.7 2.7 2.7 2.7 2.7 2.7 2.7 2.7 2.7 2	4. 4. 5. 5. 5. 5. 5. 5. 5. 5. 5. 5. 5. 5. 5.	3. 4. 4. 5. 5. 1. 1.	4 3. 4 4. 4 5. 6 4. 6 5. 6 5. 6 5. 6 5. 6 5. 6 5. 6 5. 6 5	6, 00 5, 74 5, 00 6, 64 6, 65 6, 64 6, 85 7, 4, 73 7, 4, 73 7, 5, 13 6, 5, 00 6, 83 7, 6, 13 7, 5, 13 8, 13	19 26 36 21 16 32 18 22 26 29 24 16 29 16 28 70 31 11 27	NW. E., NW. S. SW., N. E. SE. W. N. SE. N.	34	12 13 10 22 14 18 18 16 19	3 7 11 15 14 12 17	22 20 21 20 19 20 4	6 7 4 4 5 7	11 16 9 20 18 12 7	10 2 6 7 4 6 5 7 2	540574334	1 2 0 5 1 2 0 1 2 3	0. 53 1. 51 1. 38 1. 31 1. 57 1. 13 0. 98 1. 87	0. 56 0. 46 1. 05 0. 52 0. 41 0. 60 0. 55 0. 49 1. 39	13 11 7 5 9 2 1 17 22 18 18	15 20 22 19 25 26 13 8 10	35342440122	9 13 10 7 9 8 6 4 5	000000000	5 0 0 0 0 3 16 25	0000000000	0 0 1 1 12 9 3 0	0 0 0	J. F. M. A. M. J. A. S. O. N. D. Y.

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ا د	Pr	essure			,		mper						Dew p			1	Reli	tiv idit	<b>9</b> y.
d year										Me	an.								
Months and years.	Mesn.	Maximum.	Mivimum.	7 a. m.	3 p. m.	11 р. ш.	Mean.	Maximum.	Minimum.	Maximum.	Minimum.	7 a. m.	3 p. m.	11 p. m.	Moan.	7 a. m.	3 p. m.	11 р. ш.	Mean.
J M M J S O D Y	In. 80. 107 29. 960 30. 028 30. 000 29. 882 29. 978 29. 940 29. 940 30. 079 29. 976	80. 35 80. 46 80. 38 30. 09 30. 16 80. 15 30. 10 30. 12 30. 17 80. 27 30. 50	29. 70 29. 62 29. 61	48. 4 60. 5 69. 2 77. 0 79. 6 77. 9 72. 9 59. 8 51. 7 45. 0	65. 3 58. 1	58. 5 64. 1 71. 4 76. 4 79. 5 79. 0 75, 0 63. 1 56. 8 50. 2	54. 3 65. 9 73. 3 79. 7 82. 5 81. 1 76. 0 64. 5 57. 9 51. 1	71 77 87 91 95 95 94 90 82 79	29 22 33 42 54 65 69 62 47 35 30 22	86. 7 90. 1 87. 8 81. 4	41.5 45.3 57.4 66.0 72.4 75.4 74.8 71.0 57.7 49.7 41.6	9 40, 22 85, 8 89, 9 53, 7 60, 5 70, 9 72, 0 73, 1 69, 6 55, 0 45, 5 38, 7 54, 6	39. 2 51.4 60. 1 69. 2 72. 2 71. 3 69. 4 54. 8 47. 7 39. 1	40. 7 44. 0 53. 9 62. 4 71. 2 72. 4 73. 6 70. 5 58. 9 49. 1 41. 3	41. 0 53. 0 61. 0 70. 4 72. 2 72. 7 69. 8 53. 6 47. 4 39. 7	79 75	51 47 49 55 59 62 71	73 72 71 71 74 84 79 84 86 81 76 73	70 65 64 68 75 77 82 75 70 68 71
	1	Latito	ide, 47	91' N	ĭ.; lo		A W, do, 11					me, 2.:	?7 <b>s</b> lo	w, Ba	stern.	]			
J F M J J S ON	26, 286 26, 269 26, 413 26, 305 26, 287 26, 354 26, 354 26, 310 20, 873 26, 216 26, 218 26, 218	26. 81 26. 66 26. 65 26. 63 26. 58 26. 61 26. 57 26. 57 26. 75 26. 78 26. 81	25, 86 25, 71 26, 18 25, 87 25, 87 26, 12 26, 12 26, 12 25, 87 26, 00 25, 84 25, 93 25, 71		21. 7 28. 4 49. 4 52. 6 62. 0 66. 9 73. 2 72. 0 66. 8 59. 5 50. 8 42. 2 53. 8	58. 8 62. 9 60. 3 53. 1 45. 6 40. 6 34. 6	17. 3 23. 8 40. 2 45. 0 53. 0 50. 8 64. 1 61. 6 56. 0 47. 7 41. 8 36. 1 45. 5	94 96 90 80	-29 -16 9, 17 22 32 44 39 33 17 9 - 6 -28	27. 3 34. 0 53. 8 58. 2 67. 7 72. 9 77. 8 76. 5 71. 4 63. 5	47. 2 50. 9 48. 3 42. 9	7. 3 12. 1 22. 7 22. 5 32. 3 39. 9, 45. 5 40. 8 26. 8 25. 3	40. 2 31. 6 44. 7 51. 7 59. 0 55. 2	13. 2 17. 0 29. 4 26. 5 34. 9 47. 6 49. 8 44. 4 36. 1 80. 9 28. 4	11. 5 17. 8 30. 8 26. 9 87. 3 46. 4 5J. 4 46. 8 39. 6 31. 2 28. 2	66 54	72 79 71 49 55 61 64 58 49 43 48	79 76 70 54 57 70 65 59 55 58 62	78 76 69 52 57 64 66 62 57 55 60
		[Latite	ıde, 82	o 30/ ]	N.; lo		IREV de, 93					ne, 1.1	4 alow	r, Eas	stern.	]			
J. F M.	29, 959 29, 840 29, 917 29, 770 29, 714	30. 50 30. 24 30. 31 30. 13 29. 93	29. 39 29. 36 29. 55 29. 49 29. 38	47. 7 60. 4	76.1	53. 8 67. 4			13 15 81 49 52	50. 0 56. 3 66. 1 79. 7 83. 1		31. 7 81. 5 42. 7 53. 8 57. 2		55. 9	32. 8 43. 6 54. 7	82 77 83 80 81	64 53 55 51 47	72 66 70 70	73 65 69 67

SILL, FORT, IND. T. [Latitude; 34° 40' N.; longitude, 98° 23' W. Local time, 1.33 slow, Eastern.]

		LIMITIO	щю, оч	- 40 1	4., 10	ugitu	ue, 80° 23		1.00	at viii	10, 1.14	O BIOW	, 1700	OGI III.				
J M M J J S O	28, 718 28, 734 28, 775 26, 751 28, 847	29, 38 29, 19 29, 17 29, 01 28, 96 28, 98 28, 88 28, 85 29, 12 29, 09 29, 14	28, 27 28, 24 28, 52 28, 33 28, 48 28, 57 28, 52 28, 44 28, 51 28, 11 28, 11	22. 8 27. 7 40. 0 52. 1 57. 9 68. 9 62. 4 46. 9 40. 6 35. 2	35. 4 44. 2 57. 5 70. 6 73. 9 83. 5 92. 4 90. 5 83. 0 70. 6 64. 6 53. 1	28. 7. 35. 0 47. 5 59. 0 62. 3 73. 2 78. 1 76. 1 69. 6 55. 7. 50. 8 41. 8	29. 0 60 35. 6 68 48. 3 80 60. 6 87 64. 7 87 75. 0 93 80. 8 100 78. 5 103 71. 7 91 57. 7 88 52. 0 84 43. 4 70	1 6 24 37 42 59 62 56 52 33	39. 2 48. 1 60. 9 73. 2 75. 7 86. 4 94. 0 92. 5 84. 3 71. 9 66. 3 55. 1	21. 2 26. 7 38. 6 50. 2 55. 4 64. 6 63. 2 65. 8 60. 7 45. 8 40. 1 34. 1	21. 2 25. 5 35. 9 48. 3 55. 1 66. 3 68. 9 65. 0 59. 9 43. 4 35. 6 33. 1	26. 2 28. 1 36. 5 47. 5 56. 7 70. 4 69. 2 62. 8 63. 7 44. 9 31. 6 35. 4	25. 6 29. 1 39. 2 50. 3 57. 5 69. 2 70. 4 64. 9 63. 6 46. 2 35. 7 36. 7	24. 3 27. 6 37. 2 48. 7 56. 4 68. 6 69. 5 64. 2 62. 4 44. 8 34. 3 35. 1	94 91 86 87 91 93 90 88 93 88	55 49 48 68 66 49 44 53 43 35	74 74 85 88 70 89 71 59 82	76 70 70 78 72 67 67 67 67
Y	28. 771	<b>29. 3</b> 8	28. 11	49. 6	68, 3	56. 5	58. 1 103	1	70. 6	47. 6				47. 8				

## SAVANNAH, GA. [H=87. h=56.]

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(in	loue te	dine	9).					Win	ıd.							Pre	ion.		N	ım	ber	of	day	78-	-	
7 a. 10.	3 р. ш.	11 р. т.	Mean.	Total (miles).	Maximum.	Direction.	North.	Northeast.	East.	Southeast.	South.	Southwest.	West.	Northwest.	Calms.	Total.	Max. 24 hours.	Clear.	Fair.	Cloudy.	Rain or snow.	Max. below 320.	Min. below 32º.	Max. above 90°.	Thunder-storms.	Auroras.
4. 8 4. 0 3. 9 3. 6 4. 1 4. 2 3. 7 6. 3 3. 7 2. 2	5. 0 5. 2 4. 1 5. 3 5. 5 6. 1 6. 0 7. 2 4. 6 4. 3 3. 7	3. 3. 7 3. 7 4. 7 5. 0 3. 7 4. 7 3. 7 3. 7	3, 4	5, 385 5, 472 5, 899 5, 293 4, 387 4, 450 4, 660	5 40 2 21 9 31 5 20 7 19 9 28 9 56 1 27 9 32 9 23 5 31	W. W. NW. NE. S., SE. E. SW. NW. NE., E. NE., S. NW.	21 10 10 6 5 11 7 20 7 11 120	8 6 3 8 1 8 17 16 1 5	18 5 14 36 10 9	4 10 14 14	17 7 10 9	14 4 6 7 10		15 18 19 10 15 2 3 7 9 13 32 23 166	0 1 3 1	3. 11 1. 14 3. 98 8. 11 7. 88 14. 38 12. 00 7. 67 0. 61	1, 00 1, 05 0, 41 1, 81 2, 16 1, 65 4, 73 3, 17 4, 82 0, 25 3, 09	6 16 14 16	11 15 13 17 19 12 13 9 14 10	7 2 5 4 4 8 11 6 2 5	11 10 6 13 17 13 15 17 9 7 8	000000000000000000000000000000000000000	0 0 0 0 2	0 0 1 10 14 9 1 0 0	1 3 7 11 9 4 0 0 0	0 J 0 M 0 M 0 J 0 J 0 J 0 J 0 J 0 J 0 J 0 J 0 J 0 J
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5.5 3.5 2.4 2.4 4.2 4.2 4.4 4.5	5, 1 3, 4 3, 5 3, 2 4, 4 4, 7 4, 7	5.24.38.33.4.13.4.	6.2 5.7 3.2 3.1 3.1 3.1 3.1 4.2 4.2 4.2	7, 511 7, 485 5, 756 4, 658 3, 438 3, 963 3, 444 5, 619 5, 868	1 44 7 53 0 36 8 36 8 36 8 36 2 28 0 24 9 68 8 36 4 36 6 56	SW. SW. W. SWNE. W. W. N.,NE. SW. N., W. W.	1 2 3 4 3 3 2 4 8 5 1 2 3 8	10 10 19 7 13 9 8 7 3 2 2	8 4 0 2 6 11 6 19 3 11 2	2 0 0 0 0 2 1 0 0 0 2 1	1 0 1 0 1 0 0 4 7 6	35 19 48 21 8 0 4 0 8 10 15	23 34 23 28 62 55 61 54 58 52 60	5 14 9 15 4 5 10 7 7 5 8 8 0 4 8 8	14 0 0 0 3 0 0 1 1 0 1	0. 78 0. 35 0. 60 0. 82 2. 83 2. 57 1. 35 0. 25 0. 94 0. 03	0. 85 0, 22 0. 15 0. 23 0. 35 1. 04 0. 82 0. 52 0. 17 0. 93 0. 03 0. 09 1. 04	5 16 12 17 5 15 14 9 22 9	16 11 11 19 19 19 13 15 6 17 23	4 7 5 6 7 4 6 8 4 3	12 7 5 10 16 10 9 4 3 2	0000000	21 21 13 4 0 0 0 0 15 15	0 0 0 0 0 3 3 1 0 0 0	0 0 0 0 0 0 0 0	0 1 0 1 0 1 0 1 0 1 0 1 0 1 0 1 0 1 0 1
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## SILL, FORT, IND. T. [H=1,200. A=6.]

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2.53.60,82,3 5,90630						28		0			1, 39 1, 11								
3, 7 3, 3 2, 1 3, 0 6, 101 32		18									5, 72 2, 90				0				
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	24.00(0)						. 1		- 1	-	1.1	h fil	4.2			100		- 15	

# Monthly and yearly meteorological summaries—Continued. SITKA, ALASKA. [Latitude, 570 2' N.; longitude, 1350 19' W. Local time, 4.1 slow, Eastern.]

		[Lati	itude, l	570 8/	N.; le	ongit	ade, 1	350 	19 W	. Lo	cal ti	me, 4.	1 alov	r, Eas	tern.	<u></u>			
ای	Pr	essure	•			Te	mper	atu	re.				Dew 1	point.			Role um		
and year		ė	d					ė		Me									
Months and year	Mean.	Maximum	Minimum	7 a. m.	8 p. m.	11 р. m.	Mean.	Maximum	Minimam	Maximum	Minimum	7 a.m.	3 p.m.	11 р. ш.	Mean.	7 a. m.	8 p. m.	11 р. ш.	Mean.
J M M J S O N Y	In. 29, 781 29, 570 29, 950 29, 972 29, 823 29, 963 29, 563 29, 658 29, 266 29, 754	In. 30. 30 30. 11 30. 41 30. 36 30. 12 30. 37 30. 23 30. 02 29. 78 30. 27 30. 41	In. 28, 83 28, 94 29, 53 29, 42 29, 57 29, 72 29, 66 29, 09 29, 08 28, 62 28, 62	0 35, 1 35, 7 88, 9 89, 5 46, 5 51, 5 55, 5 51, 0 46, 1 88, 3 36, 0	52. 0 56. 2 58. 2 60. 0 55. 3 49. 8 41. 5 87. 6	55. 5 57. 2 59. 4	40.7 42.1 49.7	49 59 52 79 70 75 69 59 50	19 24 29 29 37 39 47 44 88 83 29 20	0 40. 7 41. 9 48. 8 48. 0 56. 9 61. 1 62. 3 64. 7 58. 5 53. 2 44. 8 41. 7 51. 7	0 30, 7 32, 9 85, 7 36, 9 43, 3 46, 8 50, 8 52, 5 48, 0 43, 0 35, 5 31, 0	84. 7 84. 1 40. 7 44. 9 49. 2 51. 4 46. 8 40. 6 32. 6 80. 5	0 81. 0 82. 6 36. 9 85. 5 47. 0 52. 0 53. 3 47. 6 41. 5 83. 5 81. 8 40. 4	0 80. 8 81. 9 86. 6 35. 3 42. 1 46. 8 51. 0 54. 1 40. 6 32. 6 31. 0 89. 9	0 80. 5 81. 6 86. 1 85. 0 41. 8 46. 2 50. 7 52. 9 47. 0 40. 9 82. 9 80. 9		81 80 82 74 72 72 72 80 79 76 74 74 78	75 78 80 83	81 80 84 77 76 75 82 83 81 78 79
		[Latit	tude, 3	B° 55′	N.; l				LLE, W.			e, 0.12	2 slow	, Eas	tern.]				
J F M J S O D Y	80, 158 29, 991 80, 062 30, 042 29, 928 30, 034 29, 961 30, 016 29, 950 29, 964 80, 075 30, 016	80. 68 80. 45 80. 54 80. 50 80. 16 30. 23 80. 19 80. 24 80. 23 80. 25 80. 59 80. 68	29. 74 29. 31 29. 66 29. 62 29. 59 29. 76 29. 74 29. 58 29. 58 29. 56 29. 46 29. 31	43. 8 89. 2 41. 5 55. 2 66. 4 74. 2 78. 5 76. 8 71. 2 57. 9 49. 3 42. 8 58. 1	50. 2 46. 5 50. 7 64. 9 74. 2 80. 8 84. 2 83. 7 77. 5 67. 9 60. 2 51. 3 66. 0	45. 8 41. 7 45. 3 57. 5 67. 0 74. 8 79. 0 78. 0 73. 3 60. 6 52. 4 45. 5 60. 0	46. 6 42. 5 45. 8 59. 2 69. 2 76. 4 80. 6 79. 5 74. 0 62. 1 54. 0 46. 5 61. 4	61 65 76 83 92	21 -16 22 33 49 59 60 62 49 46 29 24 16	53. 1 49. 1 53. 1 66. 8 76. 2 82. 8 86. 3 86. 1 78. 8 69. 5 61. 5 53. 4 68. 1	53. 4	81. 4 35. 5 49. 4 62. 1 69. 0 78. 4 72. 4 67. 4 58. 7 44. 7 85. 4	40. 6 36. 4 40. 7 54. 4 65. 1 70. 9 75. 4 74. 8 69. 5 58. 4 49. 3 40. 3 56. 8	41. 0 30. 1 39. 8 53. 0 62. 7 69. 9 74. 4 74. 0 68. 5 56. 0 47. 0 38. 6 55. 1	39. 4. 34. 6 38. 7 52. 8 63. 3 69. 9 74. 4 73. 7 68. 5 56. 0 47. 0 38. 1 54. 7	76 74 79 81 86 84 85 86 88 86 84 76 82	72 69 70 70 74 73 75 73 77 73 69 68 72	84 81 82 85 86 86 86 86 85 85 85 85 85 85 85 85 85 85 85 85 85	77 75 77 79 82 81 82 83 84 81 78 74
		[Latite	nde, 47	• <b>40</b> ′ ]					LLS VW.			ıe, 2.4	9 slow	r, Eas	tern.]				
J F M J S O N Y	28. 080 27. 988 28. 121 27. 951 27. 941 27. 941 27. 970 27. 936 28. 044 27. 876 27. 986	28. 50 28. 41 28. 36 28. 19 28. 21 28. 23 28. 13 28. 18 28. 25 28. 36 28. 44 28. 50	27. 52 27. 57 27. 84 27. 53 27. 49 27. 76 27. 76 27. 73 27. 71 27. 43 27. 53 27. 43	16. 9 82. 2 36. 0 39. 7 48. 5 55. 6 61. 3 57. 9 51. 8 88. 8 82. 1 42. 8	25. 7 89. 9 58. 0 59. 3 63. 4 69. 3 78. 0 78. 2 65. 8 55. 6 44. 8 87. 2 55. 8	23. 2 87. 6 48. 1 53. 3 59. 8 66. 9 74. 7 73. 9 61. 1 49. 6 41. 8 85. 0 52. 1	21. 9 86. 6 45. 7 50. 8 57. 2 63. 9 71. 3 70. 0 59. 6 48. 0 41. 1 84. 8 50. 1	50 54 72 75 82 87 94 99 83 75 00 57	14 20 26 28 35 44 47 47 87 26 25 13	30. 4 43. 8 57. 6 63. 1 68. 3 74. 5 83. 0 83. 3 72. 0 61. 0 49. 9 42. 8 60. 6	18. 9 80. 4 83. 5 87. 5 46. 0 58. 4 57. 2 54. 8 48. 9 37. 0 84. 9 30. 1 89. 8	41. 8 48. 5 53. 2 50. 3 46 3 31. 6 33. 3 28. 7	18. 0 84. 0 89. 7 44. 0 47. 9 55. 0 60. 8 63. 4 46. 5 41. 0 83. 8 45. 0	17. 8 83. 4 40. 5 44. 2 47. 7 56. 2 61. 9 62. 4 54. 3 43. 4 88. 6 81. 1 44. 8	16. 5 82. 2 87. 1 40. 1 45. 8 53. 2 58. 6 58. 7 52. 3 40. 5 87. 6 81. 0 42. 0	67 89 82 74 78 77 75 76 81 75 87 87	73 80 62 58 60 61 56 63 72 78 86 86	80 85 76 72 67 70 65 68 79 80 80 86 76	80 84 74 66 68 78 65 65 65 78 78 88
		[Latit	tude, 80	90 48'	N; lo				W.			e, 0.5	alow	, Eas	tern.]				
J F M J S O D Y	29. 490 29. 356 29. 418 29. 317 29. 247 29. 301 29. 298 29. 343 29. 293 29. 294 29. 341	29. 84 29. 78 29. 69 29. 50 29. 58 29. 59 29. 58 29. 63 29. 64	28. 96 28. 92 28. 99 29. 12 28. 98 28. 89 28. 85 28. 77 28. 65	16. 5 82. 8 47. 4 55. 7 65. 9 72. 5 65. 1 59. 0 46. 7 41. 2 32. 8	25. 9 41. 8 57. 5 67. 9 77. 9 85. 0 78. 1 71. 8 59. 9 50. 3 89. 7	20. 4 35. 7 50. 2 60. 7 69. 8 76. 9 69. 9	36. 8 51. 7 61. 4 71. 0 78. 1 71. 0 64. 9 52. 9 45. 6 35. 6	55 76 82 88 96 92 82 75 70	-11 12 80 88	28. 6 31. 2 45. 8 60. 8 70. 6 87. 8 79. 9 73. 1 62. 3 55. 6 44. 9 60. 0	29. 1 43. 1 52. 7 62. 2 69. 8 62. 6 56. 9 45. 0 28. 1	8. 0 28. 0 39. 3 46. 2 57. 1 64. 6 58. 5 52. 9 39. 9	16.4	23. 4 89. 9 49. 1 59. 8 66. 9	11. 9 24. 4 40. 7 47. 8 58. 9 65. 6 59. 9 54. 1 42. 3 85. 3	60 66 74 71 76 79 80 77 74 75	71 67 56 61 51 55 53 56 55 57 62 62 59		74 68 61 67 67 67 69 71 69

# Monthly and yearly meteorological summaries—Continued. SITKA, ALASKA. [H=63. A=43.1

<u> </u>		(E	(=63. h=43.]		
Cloudiness (in tenths).		Wind.		Precipi- tation.	Number of days—
7 a. m. 8 p. m. 11 p. m. Moan.	Total (milea.) Maximum. Direction.	Northeast.  East. Southcast.	Southwest.  West.  Northwest.	Total. Max. 24 hours.	Clear. Fair. Cloudy. Max. below 320. Max. below 320. Max. alove 900. Max. alove 900. Anora. Aurora.
7.4 7. 2 7. 17. 2 7. 97. 87. 87. 88. 8 5.66. 16. 5.6. 1 7. 97. 87. 57. 46. 9 4. 94. 63. 84. 4 6. 26. 95. 55. 9 8. 17. 78. 0 7. 9 8. 17. 17. 0 6. 87. 0	5, 482 44 SE. 7, 467 45 R. 6, 023 44 SE. 6, 289 32 NW. 5, 957 33 SE. 5, 716 36 NW. 4, 196 27 NW. 7, 263 42 SE. 9, 091 62 SE. 9, 091 62 SF. 83, 945 54 W.	0 7 13 22 0 6 22 30 0 0 7 14 0 6 10 2 21 1 0 0 2 8 0 0 1 9 0 5 22 26 1 5 26 40 0 7 35 40 0 1 55 12 3 37 196 256	1 3 5 6 36 1 1 4 9 11 5 10 11 17 29 3 15 11 8 10 1 10 13 27 17 2 20 27 21 12 3 3 30 6 13 2 29 19 19 14 2 4 13 9 8 1 3 0 8 9 1 2 0 0 6 1 8 3 3 10 23 33 51 12 158 175	In. In. 10, 42 2, 99 9, 868, 05 12, 103, 07 13, 42 3, 18 3, 55 1, 13 2, 36 1, 07 8, 85 1, 34 4, 00 1, 10 8, 33 1, 04 13, 55 2, 41 5, 11, 70 1, 29 102, 79 3, 18	2 9 17 20 013 0 0 0 0 F. 10 5 16 19 0 3 9 0 2 M. 4 9 17 24 0 2 0 0 1 A. 4 9 18 15 0 0 0 0 0 2 M. 4 10 17 10 0 0 0 0 0 0 J. 4 10 17 10 0 0 0 0 0 J. 7 11 13 17 0 0 0 0 1 2 A. 1 10 19 23 0 0 0 0 1 3 S. 1 10 20 25 0 0 0 1 1 JO. 3 9 18 24 0 3 0 1 2 N.
<u></u>	·		HVILLE, N. C		
6, 8 6, 1 5, 3 6, 1 5, 14, 8 4, 14, 7 8, 8 5, 3 5, 0 4, 7 4, 8 3, 6 2, 0 3, 7 4, 9 5, 1 2, 8 4, 3 5, 2 5, 2 3, 8 4, 7 5, 2 5, 6 3, 1 5, 1 6, 9 6, 1 4, 2 5, 4 4, 1 3, 7 3, 4 3, 7 6, 9 4, 9 3, 9 4, 6	7,11032 NW. 7,172 NF S. 7,350 29 SW. 7,428 33 S. 7,795 27 NE. 7,885 26 SE. 7,780 98 S. SW. 7,303 28 SE. 6,493 44 SE. 5,560 37 S. 7,065 41 SW.	21 18 6 2 15 16 2 20 14 6 3 16 13 11 5 13 6 8 5 5 12 17 7 1 5 9 9 4 11 12 7 8 26 27 7 27 14 14 5 26 8 6 27 17 7 5 3	8 10 19 9 0 0 5 14 17 13 0 7 19 11 9 4 11 15 14 4 1 22 26 13 2 0 6 27 10 4 2 2 11 6 3 0 5 7 13 8 0 17 10 4 16 1 3 10 26 12 10 4 16 1 3 10 26 12 10 16 10 9 166 104 9 16 11 10 10 10 10 10 10 10 10 10 10 10 10	1. 70 0. 61 2. 18 0. 98 1. 91 0. 97 6. 10 2. 23 2. 35 1. 26 2. 31 1. 30 5. 92 2. 21	$\begin{array}{cccccccccccccccccccccccccccccccccccc$
			E FALLS, WA =1909. \(\lambda = 40.\)	SH.	
7. 77. 86. 27. 2 6. 77. 75. 36. 6 1. 33. 32. 22. 25. 36. 84. 95. 55. 6 2. 44. 12. 32. 9 1. 31. 11. 41. 3 4. 65. 13. 34. 3 2. 04. 12. 12. 7 7. 47. 05. 36. 6 7. 06. 94. 66. 2 4. 35. 4 3. 84. 5	3, 177 28 SW. 3, 637 26 M. 4, 392 33 W. 8, 569 22 SE. 3, 941 25 SW. 2, 708 24 W. 4, 080 32 W. 2, 033 26 W. 3, 082 16 SE., SW. 2, 686 24 W.	0 6 28 3 2 4 6 7 6 6 18 8 2 9 12 5 3 8 12 7 3 10 11 7 3 14 6 6 3 9 10 9 1 8 9 6 4 10 15 3 11 10 15 5 11 10 15 5	2 24 13 14 3 6 32 12 6 9 7 21 12 3 12 4 18 15 9 16 13 20 14 0 16 13 20 10 8 6 8 14 15 6 1 11 25 12 4 14 3 17 9 3 25 5 10 13 16 2 13 108 23 144 59 169	0. 72 0. 59 0. 27 0. 21 1. 53 0. 39 3. 40 1. 55 0. 39 0. 39 0. 16 0. 09 0. 88 0. 48 0. 80 0. 50 4. 25 1. 50 1. 81 0. 33	$ \begin{array}{cccccccccccccccccccccccccccccccccccc$
			NGFIELD, ILL =644. h=61.	•	
3. 45. 44. 54. 4 4. 84. 9 3. 04. 3 4. 25. 9 3. 4. 64. 8 5. 17. 0 5. 1 16. 0 4. 16. 3 5. 25. 2 5. 65. 9 4. 85. 4 6. 65. 6 3. 5 4. 6 4. 05. 6 3. 5 4. 6 4. 05. 6 3. 5 4. 5 5. 7 6. 8 4. 1 5. 5	6, 337 26 NW. 5, 562 29 NW. 7, 493 29 W. 7, 577 28 N., NW. 6, 375 29 W. 4, 408 30 8 3, 522 25 SW. 4, 557 23 N. 4, 524 29 SW. 6, 978 27 NE. 7, 335 34 NW. 689, 737	14 5 0 8 9 7 10 4 6 17 3 1 5 8 9 11 9 8 6 12 7 6 5 11 3 3 5 1 12 6 11 9 2 7 8 12 2 7 8 12 3 13 4 7 10 3 8 8 10 0 5 8	19 10 10 21 6 6 10 19 12 7 4 19 13 22 8 20 5 8 19 15 7 3 20 10 7 8 16 11 11 16 9 11 34 11 7 8 8 10 20 5 10 22 9 14 8 11 21 7 23 12 15 21 2 15 21 2 18 11 36 11 136 19 11 36 11 17 23 12 15 21 2 15 21 2 18 11 36 19 11 36 19 11 36 19 11 36 19 11 36 19 11 36 19 11 36 19 11 36 19 11 36 19 11 36 19 11 36 19 11 36 19 11 36 19 11 36 19 11 36 19 11 36 19 11 36 19 11 36 19 11 36 19 11 36 19 11 36 19 11 36 19 11 36 19 11 36 19 11 36 19 11 36 19 11 36 19 11 36 19 11 36 19 11 36 19 11 36 19 11 36 19 11 36 19 11 36 19 11 36 19 11 36 19 11 36 19 11 36 19 11 36 19 11 36 19 11 36 19 11 36 19 11 36 19 11 36 19 11 36 19 11 36 19 11 36 19 11 36 19 11 36 19 11 36 19 11 36 19 11 36 19 11 36 19 11 36 19 11 36 19 11 36 19 11 36 19 11 36 19 11 36 19 11 36 19 11 36 19 11 36 19 11 36 19 11 36 19 11 36 19 11 36 19 11 36 19 11 36 19 11 36 19 11 36 19 11 36 19 11 36 19 11 36 19 11 36 19 11 36 19 11 36 19 11 36 19 11 36 19 11 36 19 11 36 19 11 36 19 11 36 19 11 36 19 11 36 19 11 36 19 11 36 19 11 36 19 11 36 19 11 36 19 11 36 19 11 36 19 11 36 19 11 36 19 11 36 19 11 36 19 11 36 19 11 36 19 11 36 19 11 36 19 11 36 19 11 36 19 11 36 19 11 36 19 11 36 19 11 36 19 11 36 19 11 36 19 11 36 19 11 36 19 11 36 19 11 36 19 11 36 19 11 36 19 11 36 19 11 36 19 11 36 19 11 36 19 11 36 19 11 36 19 11 36 19 11 36 19 11 36 19 11 36 19 11 36 19 11 36 19 11 36 19 11 36 19 11 36 19 11 36 19 11 36 19 11 36 19 11 36 19 11 36 19 11 36 19 11 36 19 11 36 19 11 36 19 11 36 19 11 36 19 11 36 19 11 36 19 11 36 19 11 36 19 11 36 19 11 36 19 11 36 19 11 36 19 11 36 19 11 36 19 11 36 19 11 36 19 11 36 19 11 36 19 11 36 19 11 36 19 11 36 19 11 36 19 11 36 19 11 36 19 11 36 19 11 36 19 11 36 19 11 36 19 11 36 19 11 36 19 11 36 19 11 36 19 11 36 19 11 36 19 11 36 19 11 36 19 11 36 19 11 36 19 11 36 19 11 36 19 11 36 19 11 36 19 11 36 19 11 36 19 11 36 19 11 36 19 11 36 19 11 36 19 11 36 19 11 36 19 11 36 19 11 36 19 11 36 19 11 36 19 11 36 19 11 36 19 11 36 19 11 36 19 11 36 19 11 36 19 11 36 19 11 36 19 11 36 19 11 36 19 11 36 19 11 36 19 11 36 19 11 36 19 11 36 19 11 36 1	6. 36 1. 31 2. 78 1. 18 4. 18 1. 46 1. 82 1. 00 4. 47 1. 52 6. 30 1. 97 1. 44 0. 91 2. 52 0. 95	5 16 10 15 0 2 0 4 0 A. 6 18 7 10 0 0 0 3 0 M. 5 16 9 12 0 0 0 8 0 J. 8 18 5 9 0 0 0 9 8 0 J. 9 15 7 10 0 0 0 2 7 0 A. 13 10 7 9 0 0 0 2 0 S. 12 12 9 5 0 3 0 1 0 N. 7 15 9 10 618 0 0 0 N.

## Monthly and yearly meteorological summaries-Continued. STANTON, FORT, N. MEX. [Latitude, 33° 30' N.; longitude, 105° 28' W. Local time, 2.2 slow, Eastern.]

		(man)	ude, 3	J- 30	17.7	ongre	uud, I				UCAL I	ame, z	810	, <u>Da</u>	900111				_
.•	Pr	<b>068</b> UF0	•			Те	mper	atu	re.			:	Dew 1	point.				tive dity	
d year										Ме	an.								
Months and year.	Mean.	Maximum.	Minimum.	7 a. m.	8 p. m.	11 р. m.	Mean.	Maximum.	Minimum.	Maximum.	Minimum.	7 p. m.	8 p. m.	11 р. ш.	Mean.	7 a. m.	3 p. m.	11 p. m.	Mean.
J M J SO Y	23, 960 23, 969	24. 19 24. 30	Z3. 46 23. 45	84. 9 28. 1	56. 9 50. 4	41. 5	44. 4	0 46 67 78 84 85 91 93 85 72 68 98	- 3 9 19 28 32 38 49 45 82 23 15 10 - 3	96. 8 55. 4 60. 9 67. 4 71. 2 79. 9 78. 3 76. 8 77. 0 70. 3 59. 2 53. 2 65. 5	0 13. 6 26. 2 31. 3 37. 3 41. 6 47. 0 54. 8 53. 6 46. 9 31. 9 30. 9 23. 5 36. 5	28. 0	82. 7 81. 5	29.8	30. 2 26. 6	76	43	64 73	61.
!		rT adda	-3- 20	0 59/	NT 1-					RT, 7			F1 -1-		-4	<u>'</u> '			
- 1	27, 072	· •	nde, 30				<u></u>					ime, 1.				Ė	_		$\exists$
J	26, 965 27, 066 26, 933 26, 910 26, 962 27, 008 27, 003 27, 043 27, 058 27, 031	27. 43 27. 28 27. 28 27. 130 27. 102 27. 20 27. 102 27. 12 27. 12 27. 28 27. 36	26. 67 26. 62 20. 78 26. 72 26. 68 26. 73 26. 90 26. 87 26. 87 26. 87 26. 87	31. 5 37. 1 46. 5 54. 0 68. 2 69. 4 68. 8 61. 6 51. 9 48. 1	48.9 59.9 67.8 0 78.0 6 78.0 991.9 991.9 991.7 75.3		79. 9 79. 5 72. 4 62. 9 60. 3	104 102 106 95 95 89 106		52. 5 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1 64. 1		25. 7 27. 7 40. 6 44. 4 54. 5 62. 7 63. 6 61. 5 5. 5 7. 5 44. 6 38. 6	64. 1 65. 5 63. 5 49. 7 49. 4	27. 6 31. 9 44. 2 51. 5 59. 7 70. 8 65. 1 63. 7 64. 8 49. 1 41. 7	27. 1 30. 7 43. 1 48. 8 58. 3 63. 6 63. 6 61. 9 43. 2	86 82 82 78 87 78 70	52 89 53 39 53 64 41 44 64 42 41	70 63 75 64 80 82 66 64 77 77 71 57	677 577 699 589 776 632 773 632 773 632 773 632 773 773 774 774 774 774 774 774 774 774
Д Т	28, 300	28. 76	27. 81	18. 6	85. 5	25. 3	26. 5 ····	66 108	- 8 -33	40. 5 59. 4	15. 2 32. 9	15.1	26.7	21.0	20. 9		71	84	81
		[Latit:	nde, 48	o 23'		rat(						I. ime, 3.	19 <b>s</b> lo	w, Es	steri	.]			
J F M J J S ND	29, 938 29, 912 30, 074 29, 974 29, 880 29, 945 29, 945 29, 833 29, 888 29, 619	30. 29 30. 38 80. 45 30. 22 30. 10 30. 18 30. 16 30. 11 30. 17 30. 07	29. 63 29. 70 29. 71 29. 45 29. 51	44. 4 46. 4 45. 4 49. 2 51. 7 54. 2 53. 0 54. 6 50. 8 47. 6	41. 3 45. 2 48. 5 49. 1 53. 4 57. 3 60. 1 58. 0 57. 8 52. 1 48. 5	47. 3 51. 0 53. 8 56. 5 55. 6 55. 0	47. 8 51. 2 54. 3 56. 9 55. 5 56. 0 51. 4	60 66 74	32 34 39 37 42 45 48 46 49 45	44. 8 48. 2 51. 7 52. 8 55. 6 59. 4 64. 7 60. 5 56. 1 51. 7	38. 1 41. 6 44. 3 43. 6 47. 7 50. 2 52. 1 51. 2 51. 9 47. 9 44. 6 42. 7	42.9 41.6 48.9 49.2 52.0 51.8 52.8 46.4 43.6	41. 9 44. 1 42. 5 49. 4 52. 1 55. 0 58. 9 54. 2 47. 2	41. 8 43. 0 42. 2 47. 7 50. 8 53. 7 53. 6 47. 7 44. 4	37. 2 41. 2 43. 3 42. 1 48. 0 50. 5 53. 6 53. 0 53. 5 47. 1	94	87 89 86 79 86 83 84 86 88 84 86	85 87 86 83 89 85 91 92 93 88 87	867 87 83 89 87 89 91 92 86

# Monthly and yearly meteorological summaries—Continued. STANTON, FORT, N. MEX. [H=6.150. h=1.]

										[H]	=6,	150.	h:	=1.	1												_
		line nth						Wir	nd.							Pre- tat	cipi- ion.		Nu	mb	er o	f d	lay	8			
7 p. m.	8 p. m.	11 p. m.	Mean.	Total (miles).	Maximum.	Direction.	North.	Northeast.	East.	Southeast.	South.	Southwest.	West	Northwest.	Calma.	Total.	Max. 24 hours.	Clear.	Fair.	Cloudy.	Rain or snow.	Max. below 32°.	Min. below 32°.	Alax. above 90°.	Annoras	Months and year.	•
2.6	2.73.1	2.5	2.62.3	5, 289 5, 276	38	NW.	3	0 2	  1	5 6	4.8	3 8	31	42	1 4	In. 0. 72 0. 63 0. 62 0. 50 0. 62 1. 35 8. 17 2. 57 1. 36 0. 18 0. 50 0. 35 12. 57		18 20	11 10	1	4 2 5 4 5 9 10 10 8 1 5 4 62	   0	17 26	0		J. F. M. A. S. O. N. D. O. N. D. O. Y.	
_]		<u> </u>		<u> </u>			!	8	гос	CK'	CON =3,			.T, =1.			ļ										-
4.3 2.2 4.0 1.9 2.3 1.9 0.8 1.6 1.9 2.5	4.99 5.12 2.55 2.25 2.26 3.87 3.27	3. 8 1. 8 2. 4 3. 1 2. 7 1. 5 2. 1 0. 7 1. 2	4. 3 2. 3 3. 8 2. 6 2. 5 2. 4 1. 4 2. 1 2. 1 1. 6	4, 170 5, 759 5, 888 7, 654 9, 357 7, 097 4, 585 2, 442 4, 754 2, 239	34 36 40 40 45 32 33 32 38	W. NW. SE. SE. SE. SE. SE. SE. SE.	11 8 12 6 5 2 2 3 13 3	3 0 7 9 9 1	1 10 10 4 3 3 1 2 4 4 6 1	10 8 16 25 49 57 75 51 82 33 14	11 10 26 33 13 23 13 6 0 3 3	13 15 5 7 7 1 0 0 0 2 2	5 9 7 6 2 0 0 0 1 6 17	11 5 4 5 9 0 0 0 2 7 2	26 11 6 2 2 3 3 13 5 14 9	0. 91 7. 78 0. 73 2. 44 2. 86 1. 36 0. 61 1. 22 1. 12 0. 14	0. 36 0. 49 6. 19 0. 47 1. 25 1. 48 0. 74 0. 23 0. 50 0. 60 0. 14	18 13 17 21 21 25 18	9 9 15 12 7 7 6 7 3 8 8	9 1 3 1 3 2 0 2 1 2 0	5 4 9 8 10 122 6 5 4 8 1	0 0 0		0 1 12 25 26 22 8	0 0 0 1 3 2 1 0 1	0 J. 0 F. 0 M. 0 A. 0 J. 0 J. 0 S. 0 O. N. D.	
									SU	LL (H:	Y, : =1,0	FOI 800.	RΤ,	D./ =6.		•											
5.5	5. 8	34.4	5 5. 8	6, 582	58	N.	14	3		24	6		3	333		0. 87 0. 80 0. 00 2. 88 2. 70 5. 12 2. 71 4. 50 1. 77 0. 18 0. 16 20. 80	0	4	21	6	77 122 29 122 166 160 100 5		29	0		0 J. 0 M 0 M 0 J. 0 J. 2 O. 1 D. 4	
	<u>'</u>	<u>-</u>		·		·		TA	TC	os	H 1 H=			D, =1.]		SH.	·	,								•	-
8.885.55 6.01 1.60 1.75 1.75 1.75 1.75 1.75 1.75	5.58.88	7. 5. 8.	98.8	7, 839	9 43 9 50 9 56 9 56 2 44 9 22 7 26 8 29 9 37 8 40 8 60 2 51	E. W. E. NW. SE. SW. S. E.	0 0 11 0 0 0 11 0 0 0 0 0 0 0 0 0 0 0 0	0 5 9 5 2 4 7 4 7 2 3	18 34 16 9 2 4 5 14 47 28	17 14 8 4 11 7 7 3 11 17 32 27	7 12 8 9 7 5 10 8 14 3 7	11 16 20 19 37 51 53 60 38 11 15	5 8 3 14 12 7 3 2 4 4 4	6 16 13 12 11 13 4 3 4 3 2 2	0 0 1 1 0 3 8 4 1 1 2 0	13. 2: 2. 3: 0. 3: 5. 4: 1. 7: 0. 1: 9. 6:	1 0, 77 7 0, 15 5 1, 65 7 0, 40 7 0, 05 2 0, 05 0 1, 80 1 1, 81 1 1, 81	2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	10 10 12 16 14 15 10 8	21 13 8 13 16 4 3 18 11 25 22	24 11 4 15 11 11 11 11 12 12 12 12 12 13 14 15 15 15 15 15 15 15 15 15 15 15 15 15	0 0 0 0 0 0 0 0 0 0	000000000000000000000000000000000000000	9 0 0 0 0 0 0 0 0 0 0 0	0 0 0 1 1 0 1 2	0 J. 0 F 1 M 2 A 0 M 3 J. 1 J. 0 A 1 S. 1 O. 0 N 1 D 0 Y	1

## THOMAS, FORT, ARIZ.

[Latitude, 33° 4' N.; longitude, 110° 2' W. Local time, 2.20 slow, Eastern.]

	Pr	essure				Ter	npera	tur	6.		ļ	1	Dow p	oint.		p.	Rola umi	tive dity	, ,
year										Me	en.								Ī
Months and year.	Mean.	Maximum.	Minimum.	4.40 a. m.	12.40 p. m.	8.40 p. m.	Mean.	Maximum.	Minimum.	Maximum.	Minimum.	7 e. m.	3 p. m.	11 p. m.	Meen.	7 a. m.	8 p. m.	11 p. m.	Mean.
J F M J SO DV	In. 27, 322 27, 224 27, 150 27, 104 27, 178 27, 187 26, 192 27, 178 27, 220 27, 271 27, 832 27, 551	27. 39 27. 22 27. 33 27. 33 27. 33 27. 40 27. 49 27. 61	26. 92 27. 09 26. 98 26. 95 26. 98	28. 5 81. 6 43. 5 45. 2 59. 7 69. 7 69. 1 60. 0 44. 7 87. 1 29. 2 47. 6	59. 7 66. 8 74. 6 84. 0 90. 5 95. 6 92. 3 90. 2 79. 7 65. 9 55. 9	0 88. 5 46. 7 57. 2 62. 1 70. 7 75. 2 63. 0 75. 2 60. 7 43. 2 62. 5	46. 0 55. 8 60. 6 69. 2 75. 8 83. 3 81. 5 75. 1	72 80 88 99 102 106 104 98 91 80 71	20 81 29 40 48 56 60 43 81 26	58. 2 63. 3 70. 6 77. 6 87. 5 94. 1 99. 3 96. 2 92. 4 82. 2 67. 2 60. 7 78. 7	29. 8 41. 6 43. 9 51. 4 56. 9 68. 2 67. 7 56. 5 42. 4 35. 8 27. 6	o 19. 2 22. 2 36. 1 35. 8 88. 6 40. 8 49. 5 53. 9 43. 4 29. 5 28. 9 26. 2 35. 3	27. 8 35. 2 32. 8 36. 3 40. 8 50. 6 55. 6 44. 4 36. 4 86. 1 81. 2	31. 9 41. 0 88. 5 48. 6 44. 6 54. 7 57. 8 47. 8 87. 4 40. 2 84. 1	87. 4 85. 5 39. 5 41. 9 51. 6 55. 6 45. 2 34. 4 85. 1 80. 5	68 76 70 59 52 50	32 33 22 19 19 23 31 22 39 36 44	68 58 57 43 40 35 89 45 41 44 60 72 51	45 39 35 37

## TOLEDO, OHIO.

[Latitude, 41° 40'; longitude, 83° 84' W. Local time, 0.34 slow, Rastern.]

J M J J S O D	29, 385 29, 281 29, 352 29, 333 29, 237 29, 287 29, 287 29, 289 29, 259 20, 327 20, 811	29. 83 29. 72 29. 66 29. 53 29. 58 29. 60 29. 63 29. 66 29. 70	28. 55 28. 76 28. 83 28. 93 29. 03 28. 79 28. 82 28. 87 28. 45	12. 4 23. 7 42. 0 53. 1 64. 8 70. 4 62. 9 57. 3 45. 9 89. 8 27. 8	22. 2 82. 7 51. 0 68. 7 74. 4 81. 5 71. 8 66. 8 55. 3 45. 2 83. 6	17. 8 28. 0 44. 9 56. 8 66. 2 74. 0 65. 1 62. 0 49. 7 42. 0 29. 6	28. 1 46. 0 57. 9 68. 3 75. 3 66. 9 63. 0 50. 3 42. 2 30. 2	59 56 80 83 89 93 89 82 74 68 55	-15 -2 22 82 45 54 48 40 28 26 -2	85. 7 54. 6 65. 6 76 5 83. 7 71. 5 58. 0 47. 5 87. 0	7. 4 19. 7 87. 5 49. 2 57. 9 66. 8 59. 8 54. 9 43. 6 86. 8 23. 0	6. 2 17. 1 86. 0 46. 1 55. 6 63. 8 59. 4 53. 2 43. 5 85. 5	13. 0 22. 1 86. 7 46 8 57. 7 67. 2 61. 9 57. 4 46. 7 38. 6 24. 9	10. 8 20. 5 87. 4 48. 1 57. 8 66. 9 61. 2 56. 0 45. 4 87. 5 23. 7	19. 9 86. 7 47. 0 56. 9 66. 0 60. 8 55. 5 45. 2 37. 2	75 75 80 78 74 80 88 86 91 86 82	68 65 61 58 57 62 72 66 74 78	73 74 76 74 73 79 84 81 86 84 79	71 72 70 68 74 82 78 83 77

## TOTTEN, FORT, DAK.

[Latitude, 47° 57' N.; longitude, 98° 57' W. Local time, 1.36 slow, Eastern.]

J F M. A J S	28, 392 98, 356 28, 443 28, 312 28, 363 28, 296 28, 387 28, 322	28. 82 28. 85 28. 58 28. 64 28. 71 28. 56 28. 73	27. 73 27. 82 27. 84 27. 78 27. 95 27. 71 27. 86 28. 05 27. 85	-7. 0 14. 0 33. 6 44. 5 55. 8 60. 4 53. 2	8.8 21.5 47.2 58.8 67.5 72.4 68.8	-2. 2 17. 5 88. 6 49. 7 57. 7 63. 2 58. 0	-2. 0 17. 7 89. 8 50. 8 60. 2 65. 3	89 40 74 86 88 93 86	-84 -20 14 20 85 43	7.6 27.8 51.7 64.4 72.8 77.5 71.8	-10. 8 9. 1 82. 1 40. 5 49. 8 56. 5 49. 6	9. 8 30. 0 37. 9 50. 5 55. 7 49. 0	-2. 8 17. 2 83. 8 89. 1 61. 8 59. 1 57. 5	-8. 1 12. 9 33. 6 41. 4 52. 0 58. 5 51. 8	-7. 8 13. 3 32. 3 39. 5	73 83 87 78 84 85 86	77 88 88 88 86 86 86 86 86	83 74 82 84	75 88 77 68 75 74
0 N D Y	28, 382	28. 72 28. 64 28. 85	27. 92 28. 01 27. 79	82. 4 22. 9 9. 3	49. 7 30. 1 19. 4	87. 4	39. 8 26. 0 13. 6	79 44 43	20 3 -20	52. 0 31. 9 25. 0	29. 8 20. 5 2. 2	27. 2 19. 8 5. 1	28. 8	28. 4 21. 4 8. 7	28. 1 21. 8 8. 8	81 87 83	50 78 74	1	<b>66</b>

## UNALASKA, ALASKA.

[Latitude, 53° 59' N.; longitude, 166° 32' W. Local time, 6.6 slow, Bastern.]

## THOMAS, FORT, ARIZ. [H=2,710. h=2.]

_										(H.	=2,	710.	A	<b>=2.</b>	)											
Cle	one te	line	18).				1	Vin	d.							Preci tatio	pi- n.		N	Vun	ber	rof	day	8		
7 a. m.	3 p. m.	11 p.m.	Mean.	Total (miles).	Maximum.	Direction.	North.	Northeast.	East.	Southeast.	South.	Southwest.	West.	Northwest.	Calms,	Total.	Max. 24 bours.	Clear.	Fair.	Cloudy.	Rain or snow.	Max. below 32°.	Min. below 32°.	Max. above 900.	Thunder-storms.	Auroras.
2.1 4.9 1.7 1.6 2.3 3.9 1.6 0.8 2.7 3.1	3.34.13.00 $2.50$ $2.60$ $2.60$ $2.70$ $2.70$ $2.70$	1. 6 2. 6 0. 4 1. 5 2. 1 3. 6 2. 1 0. 3 2. 1 2. 1 2. 1 2. 1 2. 1 2. 1 2. 1 2. 1	3. 6 2. 0 3. 9 1. 8 1. 9 2. 2 2. 8 3. 7 2. 0 0. 6 2. 5 2. 5	2, 12: 2, 03:	20	N. NE.	0 0 4 5 2 3 1 6 4 2 6 7	0 1 1 0 2 4 4 5 2 0 4 18 41	0 3 10 5 6 9 10 6 12 9 7 26 103	20 11 12 0 5 1 0 3 5 7 1 11 76	38 7 15 7 17 16 11 24 26 20 16 19 216	7 12 8 17 15 17 8 2 7 4 6 1 104	23 44 22 23 15 10 20 12 8 12 33 5 227	2 4 5 4	2 13 25 28 26 35 33 24 35 12 2 237	1. 00 0. 75 0. 14 0. 09 0. 18 2. 93 2. 46 0. 02 0. 01 0. 38 0. 31	0.05 0.08 2.21 1.65 0.02 0.01	22 9 23 23 21 15 12 24 31 19	7 16 16 6 9 9	4 3 4 1 0 2 0 3 0 0 2 2 2 2 2 2 2 2 2 2 2 2 2 2	23412350115541	000000000000000000000000000000000000000	0 0 0 0 0 2 13 23	0 0 0 8 24 29 26 19 4 0	1 0 0 0 3 6 2 1 1 0 0	000000000000000000000000000000000000000
		-	1		_						OLI =6			HI(									1	1.2		
5.6 5.6 7.2 6.6 3.9 4.5 4.5 4.6 8.6 7.3	5, 8 5, 6 5, 7 5, 7 6, 2 6, 2 6, 2 7, 7	4. 1 3. 1 5. 1 4. 1 3. 1 4. 1 4. 1 6. 4	5. 3 5. 2 4. 9 6. 2 5. 5 4. 2 5. 6 7. 9 7. 1 5. 4	5, 601 7, 162 6, 911 6, 22) 4, 420 5, 674 5, 066 5, 179 5, 584 6, 431 6, 382	39 5 40 1 32 1 32 1 24 1 27 5 30 2 27 4 28 1 32 2 36	NE. SW. NE. W. NW. E. W.NE S. SW.	3 2 8 6 5 8 6 11 6 9 11 3 78	12 15 20 6 13 12 5 10 3	15 11 2 10 15 14 11 1	10 12 6 3 2 4	8 10	13 12 20 18 21 10 24 23 26 16	21 17 25 16 19 24 12 13 13 10 24 36 230	10 4 11 14 12 10 11 11 11 8	1 4 8 1 0 2 1 0 8	0. 61 0. 63 2. 41 5. 11 3. 36 2. 49 3. 60 2. 17 3. 70 3. 10	0. 94 0. 40 0. 24 0. 93 1. 51 1. 01 1. 12 0. 93 1. 08 0. 99 0. 76 2. 04 2. 04	8 3 6 10 7 8 15 7 1	15 17 14 18 23 17 11 14 10	8 10 11 2 1 6 4 10 19 14	11 15 16 10 10 13 6 14 18	19 11 0 0 0 0 0 0 0	28 27 7 0 0 0 0 0 2 8	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0 0 0 3 6 8 6 1 1	0 0 0 0 0 0 0 0
		_	-						T		[=1			T, 1	DAI	K.						1				-
5.3 5.1 4.6 4.4 3.0 4.7 7.7	5.55.55.55.56.66.66.66.66.66.66.66.66.66	3.5	2.8 3.4 6.2 6.1 4.9 5.1 4.1 3.5 4.7 5.7 5.7	8, 301 9, 672 7, 774 6, 964 6, 447 8, 603 9, 561 8, 935	41 52 54 41 46 453 737 36 40 40 40 48	NW. NW. SE. NE. SE. (NW., SE. NW., SE. NW.,	}11	33 44 111 9 133 155 33 8 2 2 4 2 2 76		2 6 4 5 14 12 17 12 15 6 25 10	6 5 5 6 13 16 11 8 14 9	19 11 7 13 8 11 7 16 11	16 9 12 4 6 5 8 10 13 14 4 14	43 36 21 19 15 8 18 16 20 29 21 27	3 9 3 3 4 4 11 4 2 0	0. 25 0. 15 3. 07 1. 70 3. 45 5. 83 1. 91 0. 13 0. 66	0. 08 0. 95 0. 63 1. 55 1. 60 0. 83 0. 05 0. 30 0. 68 0. 31	15 16 5 3 11 9 7 10 13 12 6 8 8 115	7 15 11 12 11 18 15 16 13 8 14	9 8 10 3 3 1 6 16 9	5 10 10 16 13 8 3 8	24 19 0 1 0 0 0 0	28 29 9 6 0 0 4 19 30 31	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0 4 3 9 11 6 1	4 2 2 2 2 2 2 3 1 5 5 6 4 5 4 5 6 4 5
		1000	1		1				UN		AS H=			LA = 2.]	8K	Δ.						A. I			100	
87.8817.897.88688688	7.68 9.1 7.4 9.1 1.4 6.8 7.8 7.8	9. 7. 8. 6. 9. 8. 8. 8. 8. 8. 8. 8. 8. 8. 8. 8. 8. 8.	8. 2 7. 3 8. 8 7. 9 9. 0 9. 0 9. 0 9. 0 9. 0 9. 0 9. 0 9	7, 36 6, 23 7, 16	7 42 8 36 5 36 0 38 5 26 4 40 6 32 8 50 6 42 5 48	NW. SE. SE. NE. SE. NW. NW.	2 18 9 3 7 9 12 3 8 5 6 8 8 8 8 8	10 29 32 16 6 5	2 7 0 3 1 1 3	31 9 15 19 23 14 13 18 9 13	21 12 15 12 12 4 10 7 5 16	11 12 10 42 23 16 13 29 8	2 6 1 5 6 12 24 10 15	2 18 22 8 7 8 3 4 26 28	4 2 4 0 1 8 8 4 1 1	12. 40 1. 47 2. 03 4. 15 3. 34 7. 64	1. 74 1. 66 3. 06 0. 68 0. 54 1. 15 0. 92 2. 43 5. 38 2. 80 1. 66	0 1 0 2 0 2 0 2 0 1 0 1 7	8 12 13 8 3 15 4 11	18 16 22 28 14 26 19 20	24 21 11 12 18 16 26 30 22 23	14 9 1 0 0 0 0 0	23 18 17 2 0 0 4 15 20	000000000000000000000000000000000000000	0000000000	00000000

# Monthly and yearly meteorological summaries—Continued. VALENTINE, NEBR. [Latitude, 42° 50' N.; longitude, 100° 32' W. Local time, 1.42 slow, Eastern.]

		Latitu	de, 42	50′ 1	T.; lo	ngitu	de, 10	00 3	2 7	V. Lo	cal tin	10, 1.4	2 slov	v, Eac	stern.	]			
	Pı	**************************************	<b>.</b>			Т.	mper	atu	re.			]	Dew 1	oint			Rela umi		
d year										Ме	an.								
Months and year.	Mean.	Maximum.	Mimimam.	7 a. w.	8 p. m.	11 р. ш.	Mean.	Maximum.	Minimum.	Maximom.	Mimimum.	7 a. m.	3 p. m.	11 p. m.	Moan.	7 a. m.	8 p. m.	11 p. m.	Mean.
J F М.	In.	In.	In.	•	0	0	0	• 	•	0	•	•	0	0	0	::	::		
А Ј Ј								••• ••• •••		•••••							•••		
A S O N D	27. 286 27. 320 27. 230 27. 284	27. 64 27. 56 27. 60 27. 70	26, 83 26, 93 26, 74 26, 79	50. 1 87. 4 29. 2 20. 1	70. 7 57. 4 47. 0 38. 9	58. 5 44. 3 35. 7 27. 4	59. 8 46. 4 37. 3 28. 8	94 87 69 68	35 22 16 9	74. 0 61. 0 50. 7 43. 2	48. 0 34. 5 27. 0 16. 9	43. 7 30. 3 24. 8 14. 3	26.8	44. 3 32. 0 28. 6 19. 4	43. 2 29. 7 27. 3 18. 1	80 77 83 77	42 86 52 51	63 64 76 73	61 59 70 67
Y		•••••	•••••	••••	•••••	••••		•••	•••	•••••		••••	• • • • •	••••	••••		•••		
		[Lat	itude,	32° 22	N.;					, MIS W. L	S. ocal ti	me 1.	alow	r, Bas	tern.]	ı			
J	30, 000	80. 47	29, 46 29, 37	38. 9	50. 0	44. 5	44. 5	75	19	52. 5	36. 1	32. 4	37. 8	35. 6	35. 3	78	64	71	71
М.	29, 877 29, 950	30. 22 8u. 87	29. 57	40.7 47.4	61.4	46. 4 54. 5	46. 7 54. 4	78 77	17 27	52. 5 56. 2 64. 9 76. 3	36. 1 36. 7 44. 5	34. 8 37. 8	36. 6 38. 6	37. 1	35. 8 37. 8	78 70	56 46 50 55 49 58 57 67 67 48	66 54 64 70 76 83 82 86 76	71 66 67 67 67 68 68 68 68 68 68
А М. J	29, 824 29, 732 29, 828	30. 17 29. 93 29. 97	29. 54 29. 38 29. 59	59. 9 65. 1 74. 6	75. 4 79. 2 89. 9	66. 2 68. 9 77. 9	67. 2 71. 1 80. 8	90	42 51 61	81. 2 91. 6	56. 4 62. 5 70. 5	51.8 56.2 67.5	53. 4 60. 7 68. 0	52. 5 58. 4 69. 3 71. 5	52. 6 58. 4 68. 3	75 73 79 86	55 40	70 76	66
- al I	29, 825 29, 782	80. 01 29. 96	29. 64 29. 61	75. 5 73. 2	89. 7 87. 9	77. 2 77. 8	80. 8 79. 6	97	64 62	92. 4 90. 3	72. 3 71. 6	70. 8 70. 3	72. 3 70. 2	71.5 71.9	71.5 70.8	91	58 57	83 82	76 77
A 8 0	29, 773 29, 822 29, 859	29. 94 80. 15	29. 61 29. 55	68. 8 53. 8 48. 5	80. 9 69. 6	72. 0 <b>6</b> 0. 2	73. 9	92 82 85	53 38 31	83. 4 72. 0	67. 1 52. 4	65. 7 50. 1	67. 6 52. 2	71. 9 67. 4 52. 3 43. 9	66. 9 51. 5	90 88 81	67 56	86 76	81 73
N D Y	29, 859 29, 977 29, 854	30. 15 30. 34 30. 44	29. 47 29. 25 29. 25	48. 5 41. 3 57. 3	65. 0 56. 5 71. 5	54. 8 48. 2 62. 4	61. 2 56. 1 48. 7 63. 7	85 73 99	31 22 17	86. 9 59. 5 73. 9	46. 8 89. 2 54. 7	42. 6 83. 5 51. 1	42. 2 35. 6 52. 9	43. 9 34. 6 52. 4	42.9 34.6 52.1	81 75 80	47 48 54	68 62 72	65 62
	20, 001	JV. 11	20. 20	01.0									02. 0	<i>02.</i> 4	02.1	~	-		
		[Latit	tade, 4	6º 2' ]		WAI ngitu				A, WA V. Lo	cal tin	ne 2.5	3 alov	r, Eas	stera.	1			
J F																			
М.				• • • • · ·		•••••	••••	:::	:::					••••	· <b></b> ·		:::		
М. У.				••••															
J			•••••	••••										••••					
8									•										
Й D	29. 032	29. 53	28. 49	38. 0	43. 8	41.8	41. 2	62	22	48. 3	35. 2	33. 3	35. 3	33. 7	84. 1	84	73	73	77
Ÿ					••••	••••		•••	•••	•••••								]	
					. 37					N, D.				774	1				
-		[Lat	itude,	88º 54	' N.;	longi	tade,	770	8' 1		eal tin		BIOW,	East	1	1	_		_
J F M	30, 038 29, 914	30.75 30.40	29. 24 29. 09	29. 9 22. 8	36. 6 31. 9	32. d 25. 9	32. 9 26. 9 34. 5	66 51	10 2	42. 6 34. 4 43. 1	24. 8 19. 6	24. 2 18. 5 23. 7	23. 7 18. 8 25. 1	24. 2 18. 6	18.6	79 83	61 59	78 74 67	71 72
A	29, 968 29, 956	30. 38 30. 51	29, 53 29, 45	29. 5 45. 7	40. 7 62. 5	33. 4 51. 2 59. 7	53. 1	70 86	10 30	64. 5	42. 8	36. 8	37. 0	23. 3 39. 3	24. 0 37. 7	83 79 72 78 75 80 83 83 90 83 78	56 42	67 65	67 59
И. J.:	29, 861 29, 937	30, 09 30, 21	29. 41 29. 43	57. 8 66. 6	69. 3 78. 6	68. 1	62. 3 71. 1	95 95		71. 2 80. 8	53. 5 61. 8	50. 7 58. 2 65. 7	48. 7 56. 6	50, 5 58, 6	50. 0 57. 8	78 75	53 50	73	68
	29, 880 29, 885	30. 08 30. 16	29. 51	72. 5 68. 5	85. 8 81. 4	75. 2 70. 4	77. 8 73. 4	99 94	54 51	87. 9 82. 7	68. 8 65. 1	63. 1	64. 0 63. 7	67. 1 64. 2 57. 0	65. 6 63. 7	83	56	76 81	74
8::	29, 985 29, 910 29, 877	30, 26 30, 25 30, 28	29. 45 29. 05 29. 52	59. 5 49. 5 41. 2	75. 3 62. 1 50. 9	63. 6 52. 5	66. 1 54. 7 45. 3	91 75 71	35 30	76. 1 64. 2 52 1	57. 2 46. 7 38. 7	54. 0 46. 6 36. 4	55. 0 47. 1 38. 7 27. 9	48. 5 37. 9	55.3 47.4 37.7	90	50	87	79
O N	29, 961 29, 931	30. 28 30. 70 30. 75	29. 52 29. 19 29. 05	33. 1 48. 0	50. 9 42. 8 59. 8	43 8 36. 6 51. 1	37. 5 53. 0	64 99	14 2	45. 8 62. 1	30. 4 44. 7	26. 8 42. 0	27. 9 42. 2	28. 0 43. 1	27. 6 42. 4	78 80	59 56 42 53 50 56 51 59 65 57	65 73 72 76 81 80 87 80 71	71 72 67 68 68 69 74 71 79 76
Y	20, 001	30. 10	Ju. 00		55. 6	31. 1	30.0		آ ۔	Ju. 1							~	<u>. 1</u>	ت

## Monthly and yearly meteorological summaries—Continued. VALENTINE, NEBR. [H = 2006. h = 42.]

25 SIG

[Latitude, 32° 45' N.; longitude, 114° 36' W. Local time, 2.38 slow, Eastern.]

	Pr	e <b>ss</b> uro	•			Ten	opera	tur	е.			:	Dew :	point.				div dit	
Months and year.	Mean.	Maximum.	Minimum.	7 a. m.	8 p. m.	11 p. m.	Mean.	Maximum.	Minimam.	Maximum.	Minimum.	7 a. m.	3 p. m.	11 р. m.	Mean.	7 a. m.	8 p. m.	11 p. m.	Mean.
J F M J J S O N	In. 20. 060 20. 852 20. 845 20. 735 20. 629 20. 663 20. 642 20. 630 20. 718 20. 883 20. 932 20. 760	29. 98 29. 77	29. 52 29. 67 29. 46 29. 53 29. 51 29. 51 29. 52 29. 52 29. 54 29. 57	57. 2 50. 8 65. 0 68. 8	70. 5 77. 0 81. 0 90. 8 92. 5 100. 6 99. 7 96. 2 87. 0 71. 9	67.5 71.2 70.4 82.3 88.9 90.6 84.8 73.6	59. 8 67. 2 70. 7 78. 2 81. 2 89. 1 90. 5 84. 7 74. 7 63. 3	84 87 96 110 104 110 114 107 106 86 78	48 51 57 60 67 62 51 41 40	74. 2 81. 1 84. 6 94. 8 97. 3 105. 0 104. 6 100. 7 90. 6 74. 8 68. 2	45. 6 54. 5 58. 0 63. 1 67. 1 76. 0 79. 1 71. 2 61. 4 49. 3 48. 1	49. 8	43. 6 50. 5 50. 2 53. 5 00. 9 75. 9 77. 1 63. 6 54. 2	42.4 49.5 51.5 54.7 59.4 72.5 78.6 78.6 52.4 41.6	41. 9 49. 0 50. 4 54. 5 50. 3 72. 2 76. 1 70. 5 50. 1 40. 8	71 72 70 78 68 73 82 77 75 78	45 39 40 30 35 46 51 50 44 43	54 54 53 47 59 68 61 71 60	57 55 55 58 49 50 65 61 69 57 56

YUMA, ARIZ.

[H=141. h=21.]

	iorae a te							W	ind	1.							Preci tio	pita- n.		Nu	mb	er	of	dı	ys-	_		
7 a. m.	8 p. m.	11 p. m.		ALCED.	Total (miles).	Maximum.	Direction.	North.	Northeast.	East.	Southeast.	South.	Southwest.	West.	Northwest.	Calma.	Total.	Max. 24 hours.	Clear.	Fair.	Cloudy.	or sno		Min. below 32°.	Max. above 90°.	Thunder-storms.	Auroras.	Months and year.
22 1.8 2.0 4.4 0.5 1.7	3.0 3.0 3.0 3.0 3.0 3.0 3.0 1.1 1.1	1.3.2.1.2.1.3.0.0.2	02 94 12 12 42 68 70 42	001-01-0000	4, 253 2, 264 4, 180 5, 646 4, 894 5, 174 4, 677 2, 941 3, 896 4, 071	36 31 20	SE. SW. NW.	7 8 5 1 0 0 1 14 45 78	11 20 42	1 0 0 1 1 4	7 5 15 13 22 85 18	100	22 28 83 27 11	2 8 2 4 8 4 5 9 1 1 4 4 3 8	19 27 20 40 18 26 11 0 9 14 12 4	11 12 7 12 12	0.00 0.05 0.86 0.00 0.00 1.71 0.01	0. 07 0. 00 0. 00 0. 05 0. 58 0. 00	10 16 22 21 21 14 27 27	9 9 16 14 9 6 6 8 13 3 2 11	5 0 0 3 2 4 0 1 4	0 1 0 0	00000000	000000	24 27 31 31 30	000000000	0	J. F. M. A. J. J. S. O. N. D. Y.

## APPENDIX 29.

Mean range of atmospheric pressure at stations of the Signal Service, United States Army, for each month of the year. (Computed from January, 1880, to December, 1885, inclusive, except at stations opened subsequent to the former date.)

										. —		
Districts and stations.	January.	February.	March.	April.	May.	Jane.	Jaly.	August	September.	October.	November.	December.
New England :	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.						
Eastport, Me Portland, Me	1.44	1.58	1.34	1.24	0.94	0.90	0.72	0.68	1.04	1.20	1. 29	1.48
Portland, Me	1. 96 1. 04	1. 54 1. 26	1. 28 1. 06	1. 15 1. 05	0. 80 0. 80	0. 89 0. 76	0. 67 0. 66	0.71 0.58	0. 95 0. 83	1. 15 0. 95	1. 15 1. 12	1.44 1.32
Boston, Mass	1. 36	1.47	1. 25	1.13	0.83	0.85	0.63	0.69	0.87	1.07	1.07	1. 29
Block Island, R. I	1.41	1.46	1. 23	1. 15	0.88	0.81	0.61	0.64	0.79	1.00	1.03	1.23
Now Haven, Conn New London, Conn	1.38 1.38	1.43 1.48	1. 16 1. 22	1.03	0. 82 0. 85	0.78 0.80	0. 58 0. 60	0. 68 0. 67	0.82 0.83	1.02 1.04	0. 95 1. 01	1.19
Middle Atlantic States:				i				i				
Albany, N. Y	1.40	1.37	1.14	1.01	0. 77 0. 80	0.83	0. 61	0.70	0.84	0. 97	1. 02 1. 00	1.28 1.14
New York City	1.40 1.43	1.34 1.34	1.11 1.11	1.01 0.96	0.80	0.77 0.73	0. 57 0. 54	0.69 0.66	0.78 0.76	1.00 0.98	0.98	1.11
Philadelphia, Pa Atlantic City, N. J	1.39	1. 38	1. 12	0.98	0.80	0.73	0.55	0. 63	0.75	0.98	0.96	1.10
Barnegat City, N. J. ¹ . Cape May, N. J. ²	1.45	1.41.	1. 14	0.99	0. 80 0. 78	0.75 0.69	0. <b>56</b> 0. 51	0. 65	0.75	0. 99 0. 95	0. 97 0. 98	1.10
Sandy Hook, N. J	1.36 1.43	1. 33 1. 45	1.08 1.12	0. 95 1. 00	0. 70	0.77	0.57	0.02	0. 74 0. 77	0.93	0. 97	1.02 1.15
Baltimore, Md	1.34	1.31	1. 10	0. 94	0.78	0.71	0.53	0.64	0.73	0.96	0. 96	1.11
Washington City		1.30	1.05	0.94	0.78	0.71	0.58	0.63	0.71	0.04	0.94	1.11
Cape Henry, Va Chincoteague, Va	1.30	1. 26 1. 31	1.06 1.00	0.94	0. 74 0. 76	0.65 0.67	0. 55 0. 54	0. 58 0. 59	0.66 0.71	0. 89 0. 92	0. 90 0. 92	1.05 1.07
Lynchburg, Va	1. 19	1.15	0.98	0.86	0.71	0.66	0.50	0.56	0.64	0.85	0.86	1.01
Norfolk, Va	1. 24	1. 23	1.03	0.92	0.72	0.62	0. 51	0.51	0. 63	0. 84	0.86	1.02
South Atlantic States: Charlotte, N. C	1.04	0. 99	0, 87	0.78	0. 63	0. 56	0.46	0. 47	0, 54	0,71	0.79	0.89
Hatteras, N. C	1. 23	1.11	0. 97	0. 98	0.72	0.54	0.51	0.50	0. G2	0.78	0.86	0. 93
Kitty Hawk, N. C	1. 21	1. 20	1.02	0.94	0.73	0.62	0. 52	0.54	0.64	0.83	0.88	0. 99
Macon, Fort. N. C Smithville, N. C	1. 15 1. 05	1.08 1.02	0. 89 0. 89	0.94	0. 69 0. 64	0.51 0.50	0. 51 0. 46	0. 51 0. 47	0. 60 0. 64	0. 74 0. 69	0.85 0.80	0, <b>90</b> 0, <b>85</b>
Wilmington, N. C	1.06	1.05	0.80	0.83	0.65	0.52	0.47	0.50	0.72	0.71		
Charleston, S. C	0.96	0.89	0.81	0.76	0.58	0.46	0.41	0.62	0,53	0.65	0.76	0.79
Augusta, Ga Savannab, Ga	0. 98	0. 92 0. 83	0.81 0.75	0.71	0.59 0.54	0.50 0.45	0.45	0.45 0.53	0. 54 0. 48	0. 68 0. 63	0.75 0.73	0.84 0.74
Jacksonville, Fla		0.71	0. 67	0. GO	0.50	0. 40	0. 37	0.44	0.45	0.58	0.63	0.64
Florida Peninsula:				0. 52	0.43	0. 34	0. 31					
Cedar Keys, Fla Key West, Fla	0.74	0. 57 0. 38	0. 55 0. 39	0.32	0. 34	0. 27	0. 23	0. 42 0. 28	0. 38 0. 26	0. 52 0. 37	0. 54 0. 89	0. 57 0. 28
Sanford, Fla	0. GD	0. 64	0.50	0. 55	0. 46	0. 31	0. 32	0. 34	0. 36	0. 47	0.46	0.45
Eastern Gulf States:		A 000	.0.50		0, 53	0.40	0. 39		0 51			
Atlanta, Ga Pensacola, Fla	0.88 0.77	0. 83 0. 78	0.72 0.65	0.61 0.58	0. 53	0. 46 0. 39	0. 35	0. 41 0. 46	0. 51 0. <b>48</b>	0. 59 0. 51	0. 69 0. 66	0.76 0.72
Mobile, Ala	0.78	0.83	0.68	0.62	0.49	0.38	0. 33	0.44	0.48	0.53	0.71	0.77
Montgomery, Ala Vicksburg, Miss	0.82	0.79	0.70	0.64	0. 57	0.41	0. 36	0.44	0.48	0.56	0.71	0.77
New Orleans, La	0. 88 0. 77	0. 92 0. 81	0.74 0.68	0.74	0. 51 0. 44	0.39 0.34	0. 31 0. 28	0. 38 0. 36	0. <b>4</b> 5 0. <b>4</b> 0	0.50 0.49	0.77 0.73	0. 91 0. 77
Western Gulf States:	1			l								
Shroveport, La Fort Smith, Ark	0.90	0. 94	0.78	0.76	0. 54 0. 60	0.40	0.31 0.41	0. 36 0. 38	0.40	0.60	0. 96 0. 96	0.98
Little Rock, Ark	1.10	1.00 0.96	0. 85 0. 85	0.83	0. 58	0.45 0.45	0.36	0. 39	0. 45 0. 45	0. 72 0. <b>6</b> 3	0.87	1.07 1.08
Galveston, Tex	0.77	0.81	0.71	0. 69	0.48	0.33	0.27	0. 83	0.37	0.52	0.77	0.82
Galveston, Tex Indianola, Tex	0.78	0.85	0.71	0.73	0.48	0. 83 0. 40	0. 27 0. 84	0. 81 0. 32	0.87	0.52	0.80 0.82	0.88
Palestine, Tex San Antonio, Tex	0. 82 0. 71	0.88 0.92	0. 82 0. 68	0.73	0. 53 0. 52	0. 36	0.30	0. 31	0.40 0.40	0. 56 0. 55	0.79	0. 97 0. 88
Rio Grando Vallov:				1	1							
Brownsville, Tex Rio Grande City, Tex. Ohio Valley and Ten-	0.73	0.80	0. 67 0. 72	0. 67 0. 68	0. 42 0. 52	0. 30 0. 33	0. 24 0. 28	0. 42 0. 38	0. 32 0. 38	0.48 0.51	0.75	0.84
Ohio Valley and Ten-	0. 79	0. 86	0. 12	0.00	0.03	J. 33	J. 20	9. 00	v. 50	W 01	0.87	0. 88
nosseo:						ا ا						
Chattanooga, Tenn	0.92	0.91	0.82	0.69	0. 57 0. 59	0. 48 0. 50	0. 41 0. 42	0. 40 0. 40	0. 50 0. 49	0. 62 0. <b>64</b>	0.78 0.75	0.84
Knoxville, Tenn Memphia, Tenn Nashville, Tenn	1.01	1.00	0. 81	0.81	0.59	0.46	0.36	0.42	0.45	0.60	0. 15	1.03
					0.62	0.50	0.41	0.41	0.49	0.60	0.78	
¹ Station close						2 Stat	ion ele	med Or	tober	21. 188	5.	

¹Station closed December 31, 1885.

² Station closed October 31, 1885.

Mean range of atmospheric pressure at stations of the Signal Service, &c.—Continued.

Districts and stations.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
Ohio Valley and Ten- nessee—Continued: Louisville, Ky. Greencastle, Ind. Indianapolis, Ind. Cincinnati, Ohio. Columbus, Ohio. Pittaburg, Pa.	1. 15 1. 14	Inch. 1.06 1.14 1.16 1.13 1.11	Inch. 0. 93 0. 86 1. 01 0. 97 0. 98 1. 03	Inch. 0. 78 0. 74 0. 80 0. 81 0. 85 0. 86	Inch. 0. 66 0. 69 0. 71 0. 70 0. 71 0. 75	Inch. 0. 57 0. 60 0. 62 0. 60 0. 63 5. 66	Inch. 0.44 0.37 0.48 0.48 0.49 0.47	Inch. 0. 48 0. 06 0. 53 0. 53 0. 56 0. 58	Inch. 0.56 0.72 0.63 0.58 0.60 0.62	Inch. 0. 67 0. 71 0. 78 0. 72 0. 77 0. 80	Inch. 0. 85 0. 84 0. 90 0. 88 0. 92 0. 91	Inch. 1. 07 1. 20 1. 13 1. 09 0. 95 1. 00
Buffalo, N. Y. Oswego, N. Y. Rochester, N. Y. Erle, Pa Cleveland, Ohio. Sandusky, Ohio. Toledo, Ohio. Detroit, Mich. Jpper Lakes:	1. 84 1. 80 1. 24 1. 21 1. 20 1. 21	1. 25 1. 30 1. 27 1. 24 1. 22 1. 20 1. 16 1. 41	1. 12 1. 17 1. 14 1. 12 1. 07 1. 11 1. 10 1. 15	0. 96 0. 99 0. 98 0. 94 0. 89 0. 94 0. 88 0. 93	0. 76 0. 76 0. 75 0. 76 0. 77 0. 76 0. 75 0. 80	0. 72 0. 77 0. 74 0. 70 0. 70 0. 69 0. 71 0. 72	0. 55 0. 58 0. 56 0. 50 0. 51 0. 47 0. 51 0. 52	0. 69 0. 71 0. 71 0. 66 0. 60 0. 63 0. 61 0. 64	0. 78 0. 80 0. 73 0. 72 0. 06 0. 69 0. 71 0. 75	0. 92 0. 98 0. 94 0. 89 0. 85 0. 84 0. 85	1.01 1.04 1.03 0.96 0.94 1.00 1.00	1. 20 1. 25 1. 05 1. 16 1. 14 1. 15 1. 16
Alpena, Mich. Recanaba, Mich. Grand Haven, Mich. Mackinaw City, Mich. Marquette, Mich. Port Huron, Mich. Chicago, Ill. Milwaukee, Wis. Dulth Minn.	1. 28 1. 37 1. 20 1. 26 1. 21 1. 29	1. 32 1. 27 1. 23 1. 17 1. 31 1. 31 1. 16 1. 27 1. 29	1. 24 1. 28 1. 20 1. 28 1. 24 1. 17 1. 10 1. 22 1. 25	1. 09 1. 02 0. 98 1. 08 1. 03 0. 96 0. 91 1. 04 1. 08	0. 85 0. 83 0. 80 0. 79 0. 84 0. 79 0. 79 0. 82 0. 82	0. 79 0. 80 0. 71 0. 78 0. 78 0. 72 0. 72 0. 75 0. 72	0. 62 0. 06 0. 53 0. 67 0. 70 0. 55 0. 53 0. 56 0. 67	0. 72 0. 71 0. 61 0. 80 0. 75 0. 68 0. 56 0. 62 0. 74	0.89 0.88 0.79 1.00 0.98 0.77 0.76 0.84 0.91	0. 97 1. 00 0. 93 1. 05 1. 09 0. 93 0. 90 0. 97 1. 11	1.09 1.10 1.02 1.03 1.10 1.03 1.02 1.09 1.09	1. 23 1. 20 1. 21 1. 24 1. 10 1. 17 1. 18 1. 22 1. 17
Upper Mississippi Valley: Saint Paul, Minn La Crosse, Wis. Davenport, Iowa Des Moines, Iowa Dubuque, Iowa Dubuque, Iowa Kcokuk, Iowa Cairo, Ill Springfield, Ill Saint Louis, Mo	1. 17 1. 20 1. 20 1. 15 1. 21 1. 14 1. 11 1. 13	1. 14 1. 10 1. 12 1. 11 1. 11 1. 08 1. 09 1. 13 1. 09	1. 18 1. 18 1. 13 1. 10 1. 17 1. 09 0. 94 1. 08 1. 02	1. 00 0. 97 0. 89 0. 92 0. 02 0. 84 0. 86 0. 84	0. 79 0. 78 0. 79 0. 78 0. 77 0. 75 0. 63 0. 72 0. 70	0. 74 0. 71 0. 66 0. 70 0. 70 0. 62 0. 52 0. 63 0. 58	0. 56 0. 60 0. 52 0. 55 0. 55 0. 52 0. 42 0. 49 0. 46	0. 66 0. 61 0. 54 0. 54 0. 57 0. 50 0. 42 0. 52 0. 52	0. 80 0. 80 0. 74 0. 76 0. 79 0. 66 0. 52 0. 63 0. 58	1. 05 1. 02 0. 93 0. 92 0. 96 0. 88 0. 68 0. 84 0. 78	1. 04 1. 06 1. 04 1. 01 1. 07 1. 00 0. 89 0. 98	1. 14 1. 15 1. 25 1. 26 1. 26 1. 26 1. 26 1. 26
Missouri Valley: Leavenworth, Kans Omaha, Nobr Bennett, Fort, Dak.!. Huron, Dak Yankton, Dak	1. 14 1. 16 1. 14 1. 20	1. 09 1. 10 1. 12 1. 16 1. 09	1. 21 1. 12 1. 05 1. 16 1. 17	0. 96 1. 02 1. 02 1. 05 1. 04	0. 72 0. 78 0. 88 0. 84 0. 81	0. 62 0. 68 0. 72 0. 70 0. 70	0. 50 0. 57 0. 67 0. 65 0. 66	0. 49 0. 56 0. 71 0. 71 0. 65	0. 64 0. 73 0. 74 0. 81 0. 78	0. 86 0. 86 0. 91 0. 95 0. 93	1. 02 1. 01 1. 02 1. 00 1. 03	1. 14 1. 11 1. 11 1. 11 1. 00
Sxtreme Northwest: Moorhend, Minn Saint Vincent, Minu Bismarck, Dak Buford, Fort, Dak Totten, Fort, Dak Northwn Slope:	1. 25 1. 34 1. 23 1. 23 1. 19	1. 14 1. 30 1. 14 1. 16 1. 00	1. 13 1. 26 1. 12 1. 07 1. 01	0. 95 1. 02 1. 01 0. 99 0. 80	0. 83 0. 80 0. 82 0. 75 0. 69	0. 68 0. 68 0. 72 0. 72 0. 70	0. 68 0. 77 0. 67 0. 70 0. 58	0. 78 0. 83 0. 71 0. 67 0. 70	0. 84 0. 94 0. 84 0. 82 0. 87	1.03 1.06 0.94 0.87 0.82	1. 03 1. 10 0. 99 1. 04 0. 76	1, 17 1, 16 1, 16 1, 16 1, 00
Assinatoline, Fort, Mont. Benton, Fort, Mont. Custer, Fort, Mont. Helona, Mout. Maginnis, Fort, Mont Poplar River, Mont. Shaw, Fort, Mont Deadwood, Dak Chevenne, Wyo North Platte, Nebr.	0. 84 0. 89 0. 79 1. 20 0. 96 0. 86 0. 73	1. 07 1. 14 0. 86 0. 89 0. 86 1. 05 0. 09 0. 81 0. 74	0. 89 0. 98 0. 70 0. 84 0. 74 0. 92 0. 78 0. 84 0. 74 0. 95	0. 98 1. 00 0. 76 0. 82 0. 81 0. 98 0. 90 0. 83 0. 83 1. 01	0. 66 0. 62 0. 57 0. 62 0. 64 0. 76 0. 66 0. 63 0. 80	0. 52 0. 63 0. 53 0. 53 0. 57 0. 76 0. 58 0. 61 0. 54 0. 63	0. 54 0. 56 0. 56 0. 50 0. 40 0. 68 0. 53 0. 53 0. 43 0. 58	0. 60 0. 61 0. 60 0. 52 0. 50 0. 53 0. 56 0. 53 0. 43 0. 50	0. 77 0. 78 0. 74 0. 72 0. 64 0. 80 0. 72 0. 66 0. 01	0. 86 0. 83 0. 85 0. 75 0. 76 0. 79 0. 79 0. 75 0. 67 0. 83	0. 97 0. 95 0. 90 0. 82 0. 68 0. 78 0. 58 0. 77 0. 76 0. 90	1. 15 1. 16 1. 06 1. 01 0. 95 0. 96 1. 00 0. 86 0. 97
Middle Slope: Denver, Colo Pike's Peak, Colo West Las Animas,	0. 80 0. 74	0. 97 0. 75	0. 80 0. 70	0. 89 0. 74	0. 70 0. 56	0. 56 0. 51	0. 45 0. 30	0. 45 0. 35	0. 68 0. 54	0. 73 0. 62	0 80 0.84	0. 95 0. 81
Colo	1. 08 0. 93	0. 97 1. 00 0. 82	1. 10 0. 78	1. 02 1. 09 0. 84	0. 77 0. 78 0. 62	0. 59 0. 63 0. 46	0. 46 0. 51 0. 38	0. 50 0. 51 0. 36	0. 68 0. 73 0. 53	0. 79 0. 82 0. 66	0. 87 1. 02 0. 84	0. 9. 0. 9. 0. 9.
Sill, Fort, Ind. T Concho. Fort, Tex. * Davis, Fort, Tex Stockton, Fort, Tox Southern Plateau:	0.58	0. 93 0. 84 0. 55 0. 73	0. 84 0. 74 0. 54 0. 64	0. 82 0. 77 0. 53 0. 66	0. 66 0. 58 0. 43 0. 51	0. 52 0. 44 0. 29 0. 36	0. 38 0. 33 0. 23 0. 29	0. 36 0. 32 0. 24 0. 29	0. 54 0. 48 0. 34 0. 42	0.65 0.58 0.48 0.55	0. 04 0. 77 0. 56 0. 76	1. 00 0. 80 0. 61 0. 6
Santa Fé, N. Mex El Paso, Tex	0.64						0.28 0.34 n. close			0. 52		0. 7 0. (s

¹ Station closed November 30, 1885.

² Station closed September 15, 1885.

Mean range of atmospheric pressure at stations of the Signal Service, &c.—Continued.

Districts and stations.	January.	February.	March.	April.	May.	June	July.	August.	September.	October.	November.	December.
Southern Plateau—Con'd: Apache, Fort, Ariz Grant, Fort, Ariz Prescott, Ariz Thomas, Gort, Ariz Yuma, Aris	Inch. 0.54 0.50 0.59 0.61 0.78	Inch. 0. 63 0. 51 0. 68 0. 60 0. 67	Inch. 0.52 0.10 0.53 0.48 0.49	Inch. 0.46 0.40 0.53 0.51 0.51	Inch. 0.84 0.80 0.38 0.35 0.37	Inch. 0. 80 0. 26 0. 33 0. 33 0. 33	Inch. 0. 24 0. 21 0. 28 0. 47 0. 33	Inch. 0. 23 0. 22 0. 27 0. 47 0. 34	Inch. 0. 35 0. 28 0. 38 0. 39 0. 40	Inch. 0. 44 9. 36 0. 45 0. 49 0. 51	Inch. 9.57 9.51 9.57 9.58 9.54	Inch. 0.61 0.54 0.62 0.68 0.68
Middle Plateau: Winnemucca, Nov Salt Lake City, Utah. Northern Pinteau: Boise City, Idaho'	0.76 0.87	0. 78 0. 92 0. 96	0. 83 0. 84 0. 90	0. 58 0. 75 0. 76	0. 53 0. 58 0. 70	0. 48 0. 48 0. 56	0.41 0.45 0.52	0. 42 0. 41 0. 53	0. 55 0. 57 0. <b>63</b>	0. 56 0. 71 0. 72	0. 75 0. 86 0. 93	0.79 0.83
Lewiston, Idaho! Dayton, Wash. Spokano Falls, Wash North Pacific Coast:	1.00 1.10 1.09 1.00	1. 13 1. 03 1. 07	0. 95 0. 90 0. 91	0. 76 0. 68 0. 70	0. 77 0. 66 0. 70	0. 54 0. 40 0. 50	0. 58 0. 44 0. 45	0. 54 0. 46 0. 49	0. 63 0. 63	0. 86 0. 79 0. 81	0. 96 0. 88 0. 88	1. 20 1. 18 1. 15
Canby, Fort, Wash Olympia, Wash Tatoosh Island, Wash	0. 98 1. 20 1. 02	0. 98 1. 16 1. 14	0. 83 1. 03 0. 82	0. 68 0. 77 0. 69	0. 50 0. GD 0. 56	0. 48 0. 58 0. 50	0. 43 0. 49 0. 44	0. 41 0. 85 0. 46	0. 56 0. 61 0. 64	1. 17 0. 92 0. 93	0. 88 1. 01 0. 93	1. 12 1. 10 1. 20
Portland, Oreg	1. 24 1. 16 0. 77	1. 04 0. 95 0. 08	0. 98 0. 92 0. 86	0. 77 0. 75 0. 73	0. G8 0. G1 0. 46	0. 50 0. 53 0. 46	0. 49 0. 45 0. 36	0. 43 0. 88 0. 81	0. 55 0. 53 0. 20	0.84 0.72 0.57	0.94 0.87	1. 10 0. 96
Reu Bluff, Cal	0. 79 0. 72 0. 70	0. 82 0. 78 0. 73	0. 76 0. 66 0. 61	0, 63 0, 61 0, 59	0. 48 0. 41 0. 39	0. 48 0. 43 0. 38	0. 42 0. 38 0. 35	0. 40 9. 88 0. 35	0. 87 0. 40 0. 86	0. 58 0. 51 0. 48	0. 62 0. 59 0. 57	0.75 0.73 0.68
Los Angeles, Cal San Diego, Cal Alaska Stations: Saint Michael's, Fort	0. 00 0. 59 1. 79	0. 56 0. 49 1. 52	0. 40 0. 38 1. 23	0. 41 0. 36 1. 85	0. 30 0. 29 1. 04	0. 26 0. 25 0. 81	0. 25 0. 20 0. 79	0. 26 0. 25 0. 84	0. <b>3</b> 0 0. <b>3</b> 0	0. 36 0. 32	0.42 0.88	0.51 0.47
Sitka Unalaska Behring's Island, Behring Sea	1. 88 1. 94 1. 82	1.58 1.51 1.85	1. 14 1. 51 1. 17	1. 18 1. 46 1. 14	1. 06 1. 84 1. 18	0.77 1.24 0.97	0. 73 1. 05 0. 67	0. 00 1. 16 0. 84	1. 05 1. 51 1. 23	1. 30 1. 78	1.39 1.91	L 60 L 78

¹ Station closed December 31, 1885.

² Station closed November 30, 1886.

# APPENDIX 30.

Moan maximum and mean minimum temperatures (in degrees Tahrenheit), at stations of the Signal Service, United States Army, for each month of the year. (Computed from January, 1880, to December, 1886, inclusive, axoept at stations opened subsequent to the former date.)

Max Min. Max	April. May.	June.	July.	August.	September	r. October.		November. I	December
27.9 1.0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	1	. Max Min.	Max Min.	Mas Min.	Max Min.	Max	Min. Max	Min.	Max Min
27.9 11.9 20.9 14.7 33.2 20.5 44.5 32.0 65.4 33.4 34.3 34.5 32.0 16.0 83.4 18.7 40.4 23.1 53.1 35.9 65.9 65.3 35.6 65.1 35.5 65.0 65.1 35.5 65.0 65.1 35.5 65.0 65.1 35.5 65.0 65.1 35.5 65.0 65.1 35.5 65.0 65.1 35.5 65.0 65.1 35.5 65.0 65.1 35.5 65.0 65.1 35.5 65.0 65.1 35.5 65.0 65.1 35.5 65.0 65.1 35.5 65.0 65.1 35.5 65.0 65.1 35.5 65.0 65.1 35.5 65.0 65.1 35.5 65.0 65.1 35.5 65.0 65.1 35.5 65.0 65.1 35.5 65.0 65.1 35.5 65.0 65.1 35.5 65.0 65.1 35.5 65.0 65.1 35.5 65.0 65.1 35.5 65.0 65.1 35.5 65.0 65.1 35.5 65.0 65.1 35.5 65.0 65.1 35.5 65.0 65.1 35.5 65.0 65.1 35.5 65.0 65.1 35.5 65.0 65.1 35.5 65.0 65.1 35.5 65.0 65.1 35.5 65.0 65.1 35.5 65.0 65.1 35.5 65.0 65.1 35.5 65.0 65.1 35.5 65.0 65.1 35.5 65.0 65.1 35.5 65.0 65.1 35.5 65.0 65.1 35.5 65.0 65.1 35.5 65.0 65.1 35.5 65.1 35.5 65.1 35.5 65.1 35.5 65.1 35.5 65.1 35.5 65.1 35.5 65.1 35.5 65.1 35.5 65.1 35.5 65.1 35.5 65.1 35.5 65.1 35.5 65.1 35.5 65.1 35.5 65.1 35.5 65.1 35.5 65.1 35.5 65.1 35.5 65.1 35.5 65.1 35.5 65.1 35.5 65.1 35.5 65.1 35.5 65.1 35.5 65.1 35.5 65.1 35.5 65.1 35.5 65.1 35.5 65.1 35.5 65.1 35.5 65.1 35.5 65.1 35.5 65.1 35.5 65.1 35.5 65.1 35.5 65.1 35.5 65.1 35.5 65.1 35.5 65.1 35.5 65.1 35.5 65.1 35.5 65.1 35.5 65.1 35.5 65.1 35.5 65.1 35.5 65.1 35.5 65.1 35.5 65.1 35.5 65.1 35.5 65.1 35.5 65.1 35.5 65.1 35.5 65.1 35.5 65.1 35.5 65.1 35.5 65.1 35.5 65.1 35.5 65.1 35.5 65.1 35.5 65.1 35.5 65.1 35.5 65.1 35.5 65.1 35.5 65.1 35.5 65.1 35.5 65.1 35.5 65.1 35.5 65.1 35.5 65.1 35.5 65.1 35.5 65.1 35.5 65.1 35.5 65.1 35.5 65.1 35.5 65.1 35.5 65.1 35.5 65.1 35.5 65.1 35.5 65.1 35.5 65.1 35.5 65.1 35.5 65.1 35.5 65.1 35.5 65.1 35.5 65.1 35.5 65.1 35.5 65.1 35.5 65.1 35.5 65.1 35.5 65.1 35.5 65.1 35.5 65.1 35.5 65.1 35.5 65.1 35.5 65.1 35.5 65.1 35.5 65.1 35.5 65.1 35.5 65.1 35.5 65.1 35.5 65.1 35.5 65.1 35.5 65.1 35.5 65.1 35.5 65.1 35.5 65.1 35.5 65.1 35.5 65.1 35.5 65.1 35.5 65.1 35.5 65.1 35.5 65.1 35.5 65.1 35.5 65.1 35.5 65.1 35.5 65.1 35.5 65.1 35.5 65.1 35.5 65.1 35.5 65.1 35.5 65.1 35.5 65.1 35.5 65.1 35.5 65.1 35.5 65.1 35.5 65.1 35.5 6	-	0	0	0	0	0	0	0	0
85.4 17.4 87.6 19.8 41.5 24.8 63.8 85.9 63.8 87.0 57.5 25.1 63.7 9 25.1 41.0 25.1 41.0 24.8 63.8 85.0 65.8 87.0 57.0 57.0 57.0 57.0 57.0 57.0 57.0 5	482	0 64.6 47. 50.4 50.4	4 69.0 52. 78.0 61.	69.3 53. 76.2 60.	69.	6 53.0 57.8 8.68	41.0 43.0 42.8 46.4 93.3 95.0	33.0	33, 1 19, 36, 4 22, 9
3.6 0 18.6 37.5 20.4 41.6 25.6 51.2 36.6 66.2 36.6 6.2 36.6 6.2 36.6 6.2 36.6 6.2 36.6 6.2 36.6 6.2 36.6 6.2 36.6 6.2 36.6 6.2 36.6 6.2 36.6 6.2 36.6 6.2 36.6 6.2 36.2 3	525.2	68.4 56.	7 80.6 61.	388		00.3	5.15	200	2000
31.8 16.0 34.8 18.7 33.7 25.8 55.5 38.7 16.8 22.4 33.8 18.7 25.4 35.5 39.1 35.5 39.1 35.5 39.1 35.5 39.1 35.5 39.1 35.5 39.1 35.5 39.1 35.5 39.1 35.5 39.1 35.5 39.1 35.5 39.1 35.5 39.1 35.5 39.1 35.5 39.1 35.5 39.1 35.5 39.1 35.5 39.1 35.5 39.1 35.5 39.1 35.5 39.1 35.5 39.1 35.5 39.1 35.5 39.1 35.5 39.1 35.5 39.1 35.5 39.1 35.5 39.1 35.5 39.1 35.5 39.1 35.5 39.1 35.5 39.1 35.5 39.1 35.5 39.1 35.5 39.1 35.5 39.1 35.5 39.1 35.5 39.1 35.5 39.1 35.5 39.1 35.5 39.1 35.5 39.1 35.5 39.1 35.5 39.1 35.5 39.1 35.5 39.1 35.5 39.1 35.5 39.1 35.5 39.1 35.5 39.1 35.5 39.1 35.5 39.1 35.5 39.1 35.5 39.1 35.5 39.1 35.5 39.1 35.5 39.1 35.5 39.1 35.5 39.1 35.5 39.1 35.5 39.1 35.5 39.1 35.5 39.1 35.5 39.1 35.5 39.1 35.5 39.1 35.5 39.1 35.5 39.1 35.5 39.1 35.5 39.1 35.5 39.1 35.5 39.1 35.5 39.1 35.5 39.1 35.5 39.1 35.5 39.1 35.5 39.1 35.5 39.1 35.5 39.1 35.5 39.1 35.5 39.1 35.5 39.1 35.5 39.1 35.5 39.1 35.5 39.1 35.5 39.1 35.5 39.1 35.5 39.1 35.5 39.1 35.5 39.1 35.5 39.1 35.5 39.1 35.5 39.1 35.5 39.1 35.5 39.1 35.5 39.1 35.5 39.1 35.5 39.1 35.5 39.1 35.5 39.1 35.5 39.1 35.5 39.1 35.5 39.1 35.5 39.1 35.5 39.1 35.5 39.1 35.5 39.1 35.5 39.1 35.5 39.1 35.5 39.1 35.5 39.1 35.5 39.1 35.5 39.1 35.5 39.1 35.5 39.1 35.5 39.1 35.5 39.1 35.5 39.1 35.5 39.1 35.5 39.1 35.5 39.1 35.5 39.1 35.5 39.1 35.5 39.1 35.5 39.1 35.5 39.1 35.5 39.1 35.5 39.1 35.5 39.1 35.5 39.1 35.5 39.1 35.5 39.1 35.5 39.1 35.5 39.1 35.5 39.1 35.5 39.1 35.5 39.1 35.5 39.1 35.5 39.1 35.5 39.1 35.5 39.1 35.5 39.1 35.5 39.1 35.5 39.1 35.5 39.1 35.5 39.1 35.5 39.1 35.5 39.1 35.5 39.1 35.5 39.1 35.5 39.1 35.5 39.1 35.5 39.1 35.5 39.1 35.5 39.1 35.5 39.1 35.5 39.1 35.5 39.1 35.5 39.1 35.5 39.1 35.5 39.1 35.5 39.1 35.5 39.1 35.5 39.1 35.5 39.1 35.5 39.1 35.5 39.1 35.5 39.1 35.5 39.1 35.5 39.1 35.5 39.1 35.5 39.1 35.5 39.1 35.5 39.1 35.5 39.1 35.5 39.1 35.5 39.1 35.5 39.1 35.5 39.1 35.5 39.1 35.5 39.1 35.5 39.1 35.5 39.1 35.5 39.1 35.5 39.1 35.5 39.1 35.5 39.1 35.5 39.1 35.5 39.1 35.5 39.1 35.5 39.1 35.5 39.1 35.5 39.1 35.5 39.1 35.5 39.1 35.5 39.1 35.5 39.1 35.5 39.1 35.5 39.1 3	66.0	7 73.9 56.	8 78.2 63.	73.4 61.	05.0	4 62.1	4 50.	35.0	D W
188 9 24.7 41.0 26.0 44.3 30.4 53.8 33.7 45.8 33.7 45.8 33.7 45.8 33.7 45.8 33.7 45.8 33.8 45.8 33.8 45.8 33.8 45.8 45.8 45.8 33.8 45.8 45.8 45.8 45.8 45.8 45.8 45.8 45	68.9	2 77.7 60. 2 80.6 62.	81.4 Gt. 81.6 G5.	7 79.5 62.8 7 80.0 64.3 0 81.8 65.5	8 73, 2 56. 3 75, 6 59. 0 77, 7 61.	66.3	44.5 47.7 48.8 51.0 49.8 52.1	34.6 37.2 38.1	36.9 24. 41.2 28. 42.4 29.
41.8 25.4 44.0 20.4 45.8 33.7 15.8 41.0 65.8 41.0 65.8 41.0 65.8 41.0 65.8 41.0 65.8 41.0 65.8 41.0 65.8 41.0 65.8 41.0 65.8 41.0 65.8 41.0 65.8 41.0 65.8 41.0 65.8 41.0 65.8 41.0 65.8 41.0 72.4 41.0 83.4 41.0 72.4 42.0 83.4 41.0 72.4 42.0 83.4 41.0 72.4 42.0 83.4 42.0 83.4 42.0 83.4 42.0 83.4 42.0 83.4 42.0 83.4 42.0 83.4 42.0 83.4 42.0 83.4 42.0 83.4 43.4 83.4 83.4 83.4 83.4 83.4 83.4	F- 00	3 73.5 59.	3 79. 2 65.	77.8 65.	74.3	5 64.4	0 52.	38.4	80
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47.8 27.1 45.0 15.1 55.2 38.0 04.1 40.2 40.4 40.8 27.1 45.0 30.5 47.6 33.5 56.4 42.0 05.4 44.6 20.4 50.1 33.0 533.7 36.7 65.6 45.0 76.4 42.2 33.6 53.4 36.7 55.3 38.0 63.4 47.1 75.6 50.7 37.5 56.4 50.1 41.0 60.0 40.3 78.0 50.7 37.5 54.0 40.8 55.7 38.0 63.4 47.1 75.5 56.0 37.2 56.0 40.8 57.2 56.0 40.8 57.2 56.0 40.8 57.2 56.0 40.0 57.2 56.0 40.0 57.2 56.0 40.0 57.2 56.0 40.0 57.2 56.0 40.0 57.2 56.0 40.0 57.2 56.0 40.0 57.2 56.0 40.0 57.2 56.0 40.0 57.2 56.0 40.0 57.2 56.0 40.0 57.2 56.0 40.0 57.2 56.0 57.2 56.0 57.2 56.0 57.2 56.0 57.2 56.0 57.2 56.0 57.2 56.0 57.2 56.0 57.2 56.0 57.2 56.0 57.2 56.0 57.2 56.0 57.2 56.0 57.2 56.0 57.2 56.0 57.2 56.0 57.2 56.0 57.2 56.0 57.2 56.0 57.2 56.0 57.2 56.0 57.2 56.0 57.2 56.0 57.2 56.0 57.2 56.0 57.2 56.0 57.2 56.0 57.2 56.0 57.2 56.0 57.2 56.0 57.2 56.0 57.2 56.0 57.2 56.0 57.2 56.0 57.2 56.0 57.2 56.0 57.2 56.0 57.2 56.0 57.2 56.0 57.2 56.0 57.2 56.0 57.2 56.0 57.2 56.0 57.2 56.0 57.2 56.0 57.2 56.0 57.2 56.0 57.2 56.0 57.2 56.0 57.2 56.0 57.2 56.0 57.2 56.0 57.2 56.0 57.2 56.0 57.2 56.0 57.2 56.0 57.2 56.0 57.2 56.0 57.2 56.0 57.2 56.0 57.2 56.0 57.2 56.0 57.2 56.0 57.2 56.0 57.2 56.0 57.2 56.0 57.2 56.0 57.2 56.0 57.2 56.0 57.2 56.0 57.2 56.0 57.2 56.0 57.2 56.0 57.2 56.0 57.2 56.0 57.2 56.0 57.2 56.0 57.2 56.0 57.2 56.0 57.2 56.0 57.2 56.0 57.2 56.0 57.2 56.0 57.2 56.0 57.2 56.0 57.2 56.0 57.2 56.0 57.2 56.0 57.2 56.0 57.2 56.0 57.2 56.0 57.2 56.0 57.2 56.0 57.2 56.0 57.2 56.0 57.2 56.0 57.2 56.0 57.2 56.0 57.2 56.0 57.2 56.0 57.2 56.0 57.2 56.0 57.2 56.0 57.2 56.0 57.2 56.0 57.2 56.0 57.2 56.0 57.2 56.0 57.2 56.0 57.2 56.0 57.2 56.0 57.2 56.0 57.2 56.0 57.2 56.0 57.2 56.0 57.2 56.0 57.2 56.0 57.2 56.0 57.2 56.0 57.2 56.0 57.2 56.0 57.2 56.0 57.2 56.0 57.2 56.0 57.2 56.0 57.2 56.0 57.2 56.0 57.2 56.0 57.2 56.0 57.2 56.0 57.2 56.0 57.2 56.0 57.2 56.0 57.2 56.0 57.2 56.0 57.2 56.0 57.2 56.0 57.2 56.0 57.2 56.0 57.2 56.0 57.2 56.0 57.2 56.0 57.2 56.0 57.2 56.0 57.2 56.0 57.2 56.0 57.2 56.0 57.2 56.0 57.2 56.0 57.2 56.0 57.2 56.0 57.2 56.0 57.2 56.0 57.2 56.0 57.2 56.0	- 00 - -	32.2	2 86.9 67.	84.0 65.	79.7	6 08.1	0000	300	N 40 *
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49.2 31.1 55.8 38.4 560.1 41.0 68.0 49.3 78.4 560.7 37.2 551.0 40.8 55.7 42.2 62.1 40.8 72.5 560.5 74.2 560.5 74.2 560.5 74.2 560.5 74.2 560.5 74.2 560.5 74.2 560.5 74.2 560.5 74.2 560.5 74.2 560.5 74.2 560.5 74.2 560.5 74.2 560.5 74.2 560.5 74.2 560.5 74.2 560.5 74.2 560.5 74.2 560.5 74.2 560.5 74.2 560.5 74.2 560.5 74.2 560.5 74.2 560.5 74.2 560.5 74.2 560.5 74.2 560.5 74.2 560.5 74.2 560.5 74.2 560.5 74.2 560.5 74.2 560.5 74.2 560.5 74.2 560.5 74.2 560.5 74.2 560.5 74.2 560.5 74.2 560.5 74.2 560.5 74.2 560.5 74.2 560.5 74.2 560.5 74.2 560.5 74.2 560.5 74.2 560.5 74.2 560.5 74.2 560.5 74.2 560.5 74.2 560.5 74.2 560.5 74.2 560.5 74.2 560.5 74.2 560.5 74.2 560.5 74.2 560.5 74.2 560.5 74.2 560.5 74.2 560.5 74.2 560.5 74.2 560.5 74.2 560.5 74.2 560.5 74.2 560.5 74.2 560.5 74.2 560.5 74.2 560.5 74.2 560.5 74.2 560.5 74.2 560.5 74.2 560.5 74.2 560.5 74.2 560.5 74.2 560.5 74.2 560.5 74.2 560.5 74.2 560.5 74.2 560.5 74.2 560.5 74.2 560.5 74.2 560.5 74.2 560.5 74.2 560.5 74.2 560.5 74.2 560.5 74.2 560.5 74.2 560.5 74.2 560.5 74.2 560.5 74.2 560.5 74.2 560.5 74.2 560.5 74.2 560.5 74.2 560.5 74.2 560.5 74.2 560.5 74.2 560.5 74.2 560.5 74.2 560.5 74.2 560.5 74.2 560.5 74.2 560.5 74.2 560.5 74.2 560.5 74.2 560.5 74.2 560.5 74.2 560.5 74.2 560.5 74.2 560.5 74.2 560.5 74.2 560.5 74.2 560.5 74.2 560.5 74.2 560.5 74.2 560.5 74.2 560.5 74.2 560.5 74.2 560.5 74.2 560.5 74.2 560.5 74.2 560.5 74.2 560.5 74.2 560.5 74.2 560.5 74.2 560.5 74.2 560.5 74.2 560.5 74.2 560.5 74.2 560.5 74.2 560.5 74.2 560.5 74.2 560.5 74.2 560.5 74.2 560.5 74.2 560.5 74.2 560.5 74.2 560.5 74.2 560.5 74.2 560.5 74.2 560.5 74.2 560.5 74.2 560.5 74.2 560.5 74.2 560.5 74.2 560.5 74.2 560.5 74.2 560.5 74.2 560.5 74.2 560.5 74.2 560.5 74.2 560.5 74.2 560.5 74.2 560.5 74.2 560.5 74.2 560.5 74.2 560.5 74.2 560.5 74.2 560.5 74.2 560.5 74.2 560.5 74.2 560.5 74.2 560.5 74.2 560.5 74.2 560.5 74.2 560.5 74.2 560.5 74.2 560.5 74.2 560.5 74.2 560.5 74.2 560.5 74.2 560.5 74.2 560.5 74.2 560.5 74.2 560.5 74.2 560.5 74.2 560.5 74.2 560.5 74.2 560.5 74.2 560.5 74.2 560.5	25.00	3 84.3 66.	3 88.0 70.	83.0 60.	80.1	7 70.7	4 58.	4.30	00
90. 4 50 50 50 60 60 60 60 60 60 60 60 60 60 60 60 60	61.0	40	2 88.0 70.	85.1 69.	80.0	71.5	88.08	41.0	00.0
56.6 37.2 55.0 41.1 57.5 43.0 64.2 50.5 74. 54.2 98.5 57.6 43.0 00.1 44.9 07.0 52.3 71.5 55.0 40.0 54.1 36.6 58.8 40.0 71.2 52.5 79. 55.8 44.4 62.6 47.6 65.2 50.3 71.9 57.2 80.	191	81.6	7 86.0 71.	82.3	50	100	6 60	12.0	1 00 6
59.0 40.0 54.1 36.6 58.8 40.0 71.2 52.5 79. 58.8 44.4 62.6 47.6 05.2 50.3 71.9 57.2 80.	3 77.2	1 83.6	6 87.0 73,	5 85.1 72	80.6	0 73.0	5 62.	46.3	- 00
	80.0	0 84.6	4 90.1 75.	7 87. 6 72	82.8	8 75.5	95.	50.0	10 T
45 7 61 9 48 9 68 0 51 4 74 6 58 6 81.	20.00	0 87.5 72.	6 91.9 73.	89.3 71.	7 85.8 67. 0 83.0 70.	3 76.9	61.8 66.6	6 50.1	61.0 44.9
65.4 40.0 60.0 52.6 72.0 55.4 78.2 61.6 82	80.9	3 88.6	6 01. 2 75.	8 89.2 74.	85.0	7 70.4	8 70.	55.0	9

APPENDIX 30.—Mean maximum and mean minimum temperatures (in degrees Fahrenheil), at stations of the Signal Serrice, fro.—Continued.

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mber	Min.	57.0 71.6 57.3	45.44.5 40.64.45.8 800404	41455847	67.0 55.5	0.5.1.000 4 8 7 8 4 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	885 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5
November	Max	0 5 6 7 0 1 5 0	80.00 90.00 90.00 90.00 90.00	48.99.99.99.99.99.99.99.99.99.99.99.99.99	77.0	87.87.44.48.48.9 81.87.46.84.84.9 81-645788887	**************************************
October.	Min.	97.2 27.5 27.5	84.00.00.00.00.00.00.00.00.00.00.00.00.00	88589888 88599989	88	25 25 25 25 25 25 25 25 25 25 25 25 25 2	4447:544 402-1008
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APPENDIX 30.— Mean maximum and minimum temperatures (in degrece Fahrenheit), at stations of the Signal Service, fro.—Continued.

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1Station closed September 15, 1885.

*Station closed November 20, 1885.

station closed December 31, 1885.

# APPENDIX 31.

[The daily means are obtained by dividing the sum of the tri-daily observations by 3; the monthly, by dividing the sum of the daily by the number of days in the month. Observations prior to August 25, 1572, were taken at 7.35 a. m., 4.35 and 11.35 p. m., Washington time; from August 25, 1572, to November 1, 1879, at 7.35 a. m., 4.35 and 11 p. m., Washington time; from November 1, 1879, at 7.35 a. m., 4.35 and 3 and 11 p. m., seventy-fifth meridian time.] Mean monthly temperatures, and departure of 1883 therefrom (in degrees Fahrenheit), at stations of the Signal Bervice, United States Army. (Computed from to December, 1885, inclusive.)

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APPRNDIX 31.—Mean monthly temperatures, and departure of 1885 therefrom (in degrese Fahrenheit), at stations of the Signal Service, &c.—Continued.

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## APPENDIX 32.

Mean daily range of temperature (in degrees Fahrenheil), at stations of the Signal Service,
United States Army, for each month of the year 1865.

[The daily range is the difference between the highest and lowest temperatures, as recorded by self-registering thermometers; the mean daily is obtained by dividing the sum of the daily by the number of days in the month.]

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Districts and stations.	January.	February.	March.	April.	May.	June.	July.	Angust.	September.	October.	November.	December.
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Portland, Me.,		18.9	18.5	16.8	17.1	19.0	16.5	14.5	18.3	14.0	11.0	15.0
Mount Washington, N. H	24. 4	22.7	18.5	15.4	14.9	14.8	11.2	11.4	13.0	11.5	11.8	17. 4
Boston, Mass Block Island, R. I	18.9 17.4	16. 1 13. 8	18.1 14.1	17.8 14.6	15.0 11.0	21. 0 18. 2	16.9 12.7	14.5 10.5	18.1	14.8 10.6	13.6	16. 0 12. 6
New Haven, Conn	16.7	16.7	17.6	19.6	17.9	20. 9	18.0	16.4	20.9	17.9	13.9	16. 3
New London, Conn Middle Atlantic States:	15. 6	15. 6	15. 4	17. 6	14.9	17.0	15. 1	13. 5	17. 3	16.1	12.6	14. 1
Albany, N. Y	16.7	20.3	17.4	22. 2	21.1	21.5	20.0	17. 3	21. 1	17.4	12.2	14.5
New York City Philadelphia, Pa	15. 9	15. 3 (¹)	15. 4 15. 5	18.6 20.5	15. 9 17. 8	18.9 19.5	16. 1 19. 3	14. 6 16. 7	16.3 18.4	14.9 15.7	13. 3 13. 9	15. 0 15. 1
Atlantic City, N. J	16.0	15.0	13. 9 15. 7	15. 4 16. 2	17.8 12.2 12.7	15.5 15.8	13.7 12.2	13. 9 13. 2	13. 2 12. 4	13. 8 13. 4	14.0 11.2	16. 1 14. 6
Barnegat City, N. J. ² . Cape May, N. J. ²	16.4	15.7 16.2	10.7	14.0	11.7	13. 1	1L.7	12.5	13.4	12.9	(4)	(4)
Sandy Hook, N. J Baltimore, Md	15. 7 15. 2	14. 9 13. 7	14.5 14.2	17.3 18.6	13.7 15.4	18.3 18.0	16. 1 17. 0	13. 2 15. 7	15. 0 16. 3	11.8 16.3	11.5 13.2	13. 1 15. 0
Washington City	17.8	14.8	16.6	21. 7	17.8	19. 1	19. 1	17.6	18.9	17.4	13.4	15.7
Cape Henry, Va Chincoteague, Va	17. 9 16. 4	14. 4 15. 2	16.4 15.8	15.9 17.5	13. 6 15. 0	13. 5 15. 9	16. 4 14. 7	13. 3 13. 2	14. 0 14. 0	12.8 15.1	13.8 15.1	16. 9 16. 0
Lynchburg, Va	17.0	16.6	17.4	23. 3	18.3	19.0	20. 2	18.4	19.3	21.5	17.9	15.2
Norfolk, Va South Atlantic States:	16.1	15. 1	16.0	18. 3	14.7	17.4	18.0	14. 2	14.7	14.4	14.4	17. 8
Charlotte, N. C	17.0	16.7	18.7	21.5	18.5	17. 1	17. 0 10. 9	16. 4 9. 8	16. 3 9. 6	17. 2 10. 4	19.6 12.6	20. 6 13. 8
Hatteras, N. C Kitty Hawk, N. C	15. 5 16. 1	14. 4 15. 0	14.2 14.9	14. 1 15. 8	10. 3 13. 6	10.7 14.5	16. 7	11.6	10.5	10.5	13.4	15. 8
Macon, Fort, N. C	14. 2	14. 1 14. 6	14. 5 15. 5	13.6 15.8	10.3 14.6	9, 5 14, 0	8.8 12.7	9. 7 13. 9	9. 9 12. 0	11.3 16.1	13.6 16.3	14. 2 15. 0
Smithville, N. C Wilmington, N. C	19.0	17.4	18.8	18.7	16.4	16.0	15.7	15.0	15. 2	17.4	19.5	20.4
Charleston, S. C	14.8	14. 5 20. 8	15.3 22.9	15. 1 26. 1	13.7 22.5	13. 6 22. 5	13. 3 21. 7	12.5 21.6	10.7 17.7	13. 4 21. 8	15.4 25.1	17. 3 25. 6
Savannah, Ga	15. 9	17. 1	17. 2	16.8	14.9	14. 3	14.7	18. 0	10.8	13.6	16.6	19. 6
Jacksonville, Fla Florida Península:	14.5	16. 6	16. 2	17. 3	16.5	14.7	16.0	14.4	12.6	14.4	17.48	18. 5
Cedar Keys, Fla	12. 2	12.7	11.9	13. 5	11.9	71.4	11.0	11.6	11.0 40.8	12.7 7.6	13.7 8.0	16.0
Key West, Fla Sanford, Fla	8.7 16.1	9. 4 20. 1	9. 7 20. 8	9.9 20.9	10.6 18.5	10.8 17.4	11. 9 19. 2	11. 6 18. 3	16.8	15. 2	19.2	8.1 19.4
Eastern Gulf States:	1	17.8	18.1	19.0	15.8	14.8	15.4	14.9	12.6	15.9	16.0	17. 5
Atlanta, Ga Pensacola, Fla		16.6	15.7	12.0	18.8	14. 6	14.0	13.8	PL. 0	16.4	16.7	17. 3
Mobile, Ala Montgomery, Ala	17.4	18.1 20.2	19.0 21.7	15.0 21.2	16.0 19.2	17. 2 20. 3	16. 7 19. 3	15.6 17.6	14. 2 15. 0	19. 2 18. 8	18.0 18.5	18.9 20.6
Vicksburg, Miss	16.5	19.5	20. 4	19. 0	18.7	21. 1	20. 1	18.7	16.8	19.6	20. 1	20. 3
New Orleans, La Western Gulf States:	18. 5	15.0	14. 5	11.4	11.9	12.8	13.8	14.6	13.1	15.4	478.4	16. 6
Shreveport, La		20. 9	20.8	21.1	20.8	22.1	21.2	21.0	17.8	20.9	21.4	19.7
Fort Smith, Ark Little Rock, Ark		24.7 21.2	22. 8 21. 9	21. 4 20. 1	19. 9 18. 2	18. 2 17. 4	20. 1 18. 8	20. 6 18. 5	20.7 16.1	24.6 19.1	23.6 20.7	21.0 18.1
Galveston, Tex	13. 3	14.4	12.3	9. 9	10.8	9.8	10.6	9.6	8.9 11.4	71.4 13.8	11.8	12.4
Indianola, Tex Palestine, Tex	13. 1 16. 5	14. 5 21. 0	12. 1 19. 6	12. 1 18. 6	13.0 18.4	14. 1 18. 6	15. 1	18.5 18.5	16.8	20.6	14.3 18.7	13.7
San Antonio, Tex		(4)	18.9	18.9	17.5	20. 3	18.5	22. 1	19.4	24. 2	24.8	22.6
Rio Grande Valley: Brownsville. Tex	16.7	17. 8	13. 5	14.8	15. 3	16.4	15.0	16.1	15.1	17.1	19.5	20.3
Rio Grande City, Tex.	17.3		15.7	20.0		•	22.8	-	•	17.6	21.8	30:0
¹ Record inc	comple	te.			≖ St	ation (	closed :	The COET	DOT MI.	·1609.		

¹ Record incomplete.

Station closed October 31, 1885.

<sup>Station closed December 31, 1895.
No record.</sup> 

Mean daily range of temperature (in degrees Fahrenheit), &c.—Continued.

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Districts and stations.	January.	February	March.	April.	May.	June.	July.	August.	September.	October.	<b>November.</b>	December.
Ohio Valley and Tennes-	0	0	0	0	o	0	0	0	۰	0	0	•
Chattanooga, Tenn	16.1	19.6	19.0	19.0	18.8	18.3	17.6	15.9	14.0	16.5	17.8	19.7
Chattanooga, Tenn Knoxville, Tenn Memphia, Tenn	17.3	19. 2 16. 7	21. 0 17. 0	22. 3 18. 0	19. 9 20. 6	18.8 18.3	19. 8 16. 0	17.9 17.0	18.9 15.5	20. 9 16. 9	16.7 17.6	18. 0 17. 1
Nashville, Tenn Louisville, Ky Greencastle, Ind	1 19. 2	20. 1 18. 4	21. 1 16. 5	19, 9 20, 3	18. 1 19. 8	16. 1 21. 0	17. 2 22. 4	17. 8 18. 8	17. 0 17. 1	19. 4 16. 4	16.9 14.1	16. 9 16. 1
Indianapolis, Ind	14.8	20.8 18.4	17. 1 14. 9	17.8 17.3	16. 9 20. 2	16.2 21.0	15. 9 20. 8	16.3 20.9	15. 0 20. 1	15. 0 18. 7	13. 9 13. 6	14. 9 15. 2
Cincinnati, Ohio Columbus, Ohio	15. 5 15. 7	19. 6 20. 3	18. 2 16. 4	19. 3 20. 1	19.3 20.5	18.5 19.6	19.7 18.7	18.3 17.2	18, 8 20, 5	17. 8 18. 7	13. 0 18. 1	15. 4 15. 4
Pittsburg, Pa	17. i	19. 3	17. i	21. 9	20.0	24.1	22. 0	19.6	22.1	18. 7	12.4	14.7
Buffalo, N. Y	13. 9	17. 9	15. 4	16.0	15. 7	14.3	15. 0	13.5	15.7	13. 6	9.8	13. 4
Oswego, N.Y Rochester, N. Y	17.6	19.3 18.8	14. 2 16. 1	15. 9 19. 4	17. 2 19. 9	19.5 23.8	15.3 20.5	12.8 17.3	16.8 21.2	14. 2 16. 7	11.5 13.8	14.7 15.1
Erie, Pa	14.2	18.5 18.9	16.5 16.0	17. 2 17. 1	16.5 16.6	18.9 18.0	16. 1 16. 4	15. 4 15. 1	17. 0 17. 1	16. 4 15. 6	14.0 11.2	17. 0 13. 7
Sandusky, Ohio Toledo, Ohio	15. 2	19.4	15.3	16.4	16.4	20.7	16.6	15. 2	17.3	15.5	11.4	14. 4
Detroit, Mich	15. 5 16. 6	19. 2 20. 6	16. 0 16. 4	17. 1 17. 3	16. 3 16. 9	18. 6 19. 4	17. 5 19. 1	15.4 14.8	16. 6 15. 9	14. 4 14. 4	10. 7 10. 6	14. 0 13. 3
Upper Lakes: Alpena, Mich	15.5	20. 0	23. 2	18, 1	16.9	23. 1	19.6	16.5	18.7	14.4	9.9	11.8
Escanaba, Mich Grand Haven, Mich	16.5 12.7	20. 9 16. 9	24. 5 16. 7	16.6 14.4	17.0 17.2	20. 6 16. 7	17. 1 16. 7	15, 0 13, 5	17.5 14.8	13. 3 15. 3	8.9 12.6	11.5 10.9
Mackinaw City, Mich Marquette, Mich	15.6	19.7	24. 5 19. 8	17. 6 17. 4	17. 0 17. 4	20. 0 21. 8	19. 1 20. 2	13. 6 15. 0	14. 8 20. 9	11.8	7.8	10.5
Port Huron, Mich	16.0	20. 7	18.5	16, 6	17. 2	20.6	16.9	16.0	18.0	13. 5 14. 6	8.6 10.2	15. 3 12. 4
Chicago, Ill	16.4	18.0 17.8	15. 3 14. 9	15. 2 14. 6	14. 5 17. 5	16. 4 20. 4	15. 3 18. 7	11.9 14.3	12. 3 16. 2	12. 1 13. 5	11. 9 10. 5	14. 2 12. 8
Duluth, Minn	20.6	21.0	19. 1	18.6	17. 5	18.0	17.5	14.7	17.0	14. 1	8.3	15. 6
ley: Saint Paul, Minn La Crosse, Wis. Davenport, Iowa	10.0	20. 6	20. 2	20.3	22. 9	22. 2	20, 4	17. 7	22. 3	100	10.4	15.77
La Crosse, Wis	17.4	17. 3	15. 6	14. 2	17.8	17.0	16.5	14. 5	16. 3	18.8 15.1	12.4 11.4	15.7 18.5
		19.3 16.7	16. 8 18. 0	16. 1 18. 8	19.8 23.2	18. 2 20. 8	19.4 21.8	18.0 19.4	17.0 17.4	16. 6 18. 1	14. 9 15. 7	14.7 15.0
Dubuque, Iowa Keokuk, Iowa Cairo, Ill Springfield, Ill	19. 6 17. 2	20. 7 18. 1	17.0 16.7	16.8 16.7	21.3 19.4	19. 4 17. 5	20.3 18.6	18, 4 20, 1	18. 1 17. 2	17. 5 18. 8	14.9 18.1	15. 0 16. 8
Cairo, Ill	15.8	16. 9 19. 6	16. 4 16. 7	17. 9 17. 2	15. 8 17. 9	15. 8 17. 8	14. 7 18. 0	15. 2 17. 2	13. 7 16. 2	15. 9 17. 2	15.5 17.6	16. 2 16. 9
CHILL TANKED, WAY	19. 3	21. 4	17.8	17. 5	15. 9	15. 9	15. 2	15.7	14. 8		15. 9	17. 4
Missouri Valley: Lamar, Mo			221.2	21.0	19. 4	17.4	18.7	19.6	99. 2	23. 6	22.6	19.7
Leavenworth, Kans Omaha, Nebr	20. 2 18. 4	19. 6 ( ² )	21. 2 19. 3	17.8 17.8	19. 8 19. 1	18.6 19.3	20.0 18.9	20. 4 17. 3	19. 5 17. 1	21. 7 19. 6	19.8 16.0	16. 9 16. 7
Valentine, Nebr Bennett, Fort, Dak.4.		20. 9	23. 7	26. 6	24.9	23. 1	24.0	21.6	² 25. 9 24. 6	26. 5 30. 7	23.8 17.9	26. 3 (1)
Huron, Dak	20.8	21.5	22.0	25. 3	25. 2	22.6	23.0	20. 1	24.3	28.0	15.7	19.4
Yankton, Dak Extreme Northwest:	17.5	17.7	21.5	24. 1	23. 2	21.0	21. 2	18. 2	22.7	24.6	19.0	20. 0
Moorhead, Minn	21. 5 26. 3	21.7 21.7	21. 0 23. 1	20. 1 20. 2	23. 3 22. 1	23. 0 23. 0	22. 0 20. 2	24. 7 24. 3	28. 2 27. 7	26. 0 22. 0	12.5 12.8	20. 5 21. 9
Bismarck, Dak	20. 8 24. 4	20. <b>6</b> 21. 2	18. 2 19. 2	20. 8 24. 9	23. 6 28. 6	23. 1 26. 0	21. 7 25. 4	22.3 24.8	26. 9 80. 5	25. 5 28. 4	14.7 16.0	21. 2 19. 2
Buford, Fort, Dak Totten, Fort, Dak Northern Slope:	20. 9	17. 9	18. 2	19. 6	23. 9	23. 6	21.0	22. 2	26. 4	22. 2	11.4	22.7
Assinaboine, Fort,								07.0		SS 4		~~ ~
Mont Benton, Fort, Mont	19. 5 25. 0	19. 0 22. 1	23. 0 25. 5	24. 6 27. 5	29. 0 30. 2	28. 1	26. 2 29. 1	27. 3 30. 3	28. 4 29. 8	29. 4 30. 9	26. 7 28. 0	22.7 22.9
Benton, Fort, Mont Custer, Fort, Mont Helena, Mont	20.5	22. 1 15. 7	26. 4 18. 6	28. 4 18. 8	32. 8 22. 2	28. 1 21. 8	32.4 24.7	31.7 26.8	30. 0 24. 3	86. 8 25. 7	29. 3 17. 0	24. 7 15. 5
Maginnis, Fort,	18.8	17. 8	21.0	22. 6	26. 1	23. 9	24. 4	24. 3	27. 0	26. 8	21.0	16.6
Poplar River Mont	23. 7 20. 0	21. 9 20. 3	19. 2 25. 9	26. 0 26. 0	30. 6 28. 4	27. 5 25. 7	28. 8 26. 9	26. 6 28. 1	34. 5 28. 5	32.4	(1)	22.7
Doedwood, Dak	16.8	17.4	15.7	17.5	20. 3	18, 8	20.9	20.7	21.0	30. 2 20. 9	19.1	19. 1 17. 6
Shaw, Fort, Mont Deadwood, Dak Cheyenne, Wyo North Platte, Nebr	23. 5 21. 2	20. 2 19. 6	21.3 22.8	21, 8 22, 1	24. 3 19. 5	26. 5 22. 3	27. 5 21. 6	26. 1 19. 1	26. 4 22. d	26. 5 26. 9	24. 0 20. 1	22. 7 20. 1
Middle Slope:	23. 0	23. 4	26. 6	23. 0	22. 5	27. 2	27. 0	26.3	26. 4	27. 4	26. 8	24.5
Denver, Colo Pike's Peak, Colo West Las Animas,	11.7	11. i	10.6	10,4	9.8	11.6	13.0	11.2	12. 0	9, 9	10. 2	11.6
Colo	81. 3	29. 3	34. 4	B0. 1	28. 1 221. 5	30. 2	28. 4 19. 1	29. 2 28. 9	33. 0	34. 3	32. 0	27. 9
Concordia, Kans  1 No record	•	·•••••		******			ncomp		. 21. 3	21. 1	21. 7	19. 6

No prior record.

^{*}Record incomplete.

*Btation closed Nevember 30, 1885.

Mean daily range of temperature (in degrees Fahrenheit), &c.-Continued.

Districts and stations.	January.	February.	March.	April.	May.	June.	July.	August	September.	October.	November.	December.
	0	۰	٥	•	•	•	•	•	•		•	
Middle slope—Continued:	18.8	22. 9	27.0	25.0	21.8	21.7	21.6	20.7			١.,	
Dodge City, Kans Elliott, Fort, Tex Southern Slope:	20. 3	19.8	25. 9	23.5	21.5	20. 9	22. 9	22.7	21. 9 24. 5	25. 6 30. 3	22. 4 29. 8	19.6 22.6
Sill, Fort, Ind. T	18.0	21.4	22.3	23.0	20. 3	21.8	25. 8	26.7	23.6	26.1	26. 2	21.0
Abilene, Tex	22. 4	28. 1	23. 2	24. 9	24. 0	28.6	27. 6	27.4	(7)	25.2	24.0	23.9
Davis, Fort, Tex	25. 6	28.5	24.5	26.8	25. 9	26.0	24.6	124.8	25.6	28. 4	28. 1	28.5
Stockton, Fort, Tex Stanton, Fort, N.	25. 4	30. 7	24. 1	29. 4	29.4	29.8	27.4	27.1	27.3	20.9	34.2	(4)
Mex	•••••						•••••	ļ		·····	28.3	29.7
Santa Fé. N. Mex	23. 8	20.4	20.9	21.0	21.6	22. 9	23.4	22.8	24.0	25. 2	20.4	20.8
El Paso, Tex Apache, Fort, Aris	26. 9 29. 5	30. 6 33. 7	27. 5 29. 6	3L.4 32.9	82.7 87.0	34.3 40.6	82. 0 85. 8	87. 9 80. 0	27.8 87.0	29. 4 48. 0	28. 2 32. 5	29.2 33.2
Grant, Fort, Aris	20.8	24. H	22.8	24.4	25. 5	23.7	23.0	20.7	2L.5	23.0	19. 2	20.6
Prescott, Aris Thomas, Fort, Ariz	24.0	29. 4	28. 2	26.5	30.7	83. 2	29. 4	25.6	88.5	85.8	27.8	27.5
Thomas, Fort, Ariz	27. 2	84.0	29.0	83. 8	36. 1	87.2	81.2	28.4	35.8	39.9	81.8	33.1
Yuma, Ariz Middle Plateau:	22. 9	28. 6	26.7	26. 5	81.7	30. 2	28.9	25. 4	29.8	20.4	25. 0	20.1
Bidwell, Fort, Cal			<b></b>		(¹) 27. 9	(P) 26.5	43.8	(3)	41.8	40.3	14.5	15.0
	17. 9	17.4	81. 9	25.7			81.5	83.7	82.7	85.7	19.1	17.7
Frisco, Utah Salt Lake City, Utah	14.5	11.6	18. 1	17.6	21. 1	( ³ ) 22, 1	18.0 26.4	19.4 26.4	18.6 26.6	17.9 26.0	15.1 19.1	16.2
		121.5	27. 7	22.4	27. 0	29. 2	80.4	29.9	81.8	82.9	27. 2	21.2
Bridger, Fort, Wvo								120.4	80.4	8L.3	27.6	20.2
Northern Plateau:	18.0	13.4	23.8	24. 3	22.7	23.9	28.4	28. 3	25.8	25.1	,,,	10.0
Boise City, Idaho	14.7	14.0	23. 2	28.6	23.0	22.7	26.9	81.1	24.8	25. 2	12.4	16.0 12.2
Lewiston (5), Idaho Dayton (6), Wash Spokane Falls, Wash.	18.7	13. 0	26. 1	30. 2	25. 2	25.4	84.0	85. 9	29. 2	29.9	18.4	(7)
Spokane Falls, Wash.	16.4	12.8	24. 1	25.6	23.3	21. 2	25.8	28.6	21. 4	24.1	15.0	12.0
North Pacific Coast: Canby, Fort, Wash	7.4	7. 3	10.0	9. 5	9. 3	8.4	9.8	8.8	8.6	9.6	7.5	6.1
Olympia, Wash	11.3	11.4	21.6	26.9	24.5	22.5	28.0	26.5	18.4	21.2	านั้นไ	11.0
Port Angeles, Wash		113.5	16.7	19.8	15.3	18.3	17. 9	16.5	13.7	16.3	14.8	14.0
Tatoosh Island, Wash	6.7		7.8	9.2	7. 0	9.2	12.5	13.5	8.6	8.2	6.9	7. 0
Portland, Oreg	11.2	6.6 11.8	20.6	26.8	25.6	28.8	25.8	29.7	22.7	23.1	16.9	12.2
Roseburg, Oreg	14.8	18.8	25. 8	27. 5	24. 8	21. 8	29. 9	80.6	29.1	28.0	15.1	11.5
middle Lacine Coast:			1	10.2		,, ,	12.6	11.6		13.4	10.0	
Cape Mendocino, Cal. Keeler, Cal	8.7	8.2	9.9	28.8	11. 1 24. 6	11.6 25.8	27.1	24.6	11.6	23.1	17.8	9. 7 16. 9
Red Bluff, Cal	16.3	18.8	25. 5	21.6	26.6	25. 1	28.7	80.9	27.7	25. 2	11.8	11.7
Sacramento, Cal	10.7	16.2	20. 2	19.8	25.0	24.0	26.5	82.1	3L.9	28.6	12.4	8.8
San Francisco, Cal South Pacific Coast:	7.8	10.0	11.3	10.1	10.8	9.7	10.9	10. 1	18.4	11.1	7.8	10.9
Los Angeles, Cal	21. 2	25. 8	24.8	21.7	2L.8	27. 2	27.2	28.0	28. 2	27. 1	18.6	19. 5
San Diego, Cal	17.2	18.2	16.6	14.5	11.8	12.6	11.9	12.0	13.4	14.2	15.4	17.4
San Luis Obispo, Cal Alaska Stations :			•••••			23.5	23.1	26. 2	28.7	24.8	17. 3	18. R
	12.7	18.5	14.5	11.8	14.5	12.8	1L.8	12.1	11.4	12.8	16.8	17. 1
Saint Michael's Fort:	18.5	17.9	15.2	12.7	13.6	11.1	11.8	10.8	7.6	7. 9	12.4	18.6
Sitka	10.0	9.1	11.1	11.1	13.5	14.8	11.5	12. 1 11. 7	10.5	10.3	9.3	10.7
Unalaska Behring's Island, Behr-	7. 6	10.9	10. 2	12.8	13.1	11.6	11.5	11.7	2.9	9.2	9.4	8. 1
ing Sea	9.2	10.6	7.6	9.6	7. 1	8.7	8.7	7.5	7.3	9.5	10.0	8.2
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No prior record.
 Record incomplete.
 Station closed September 15, 1885.

⁴ No record.
5 Station closed December 31, 1885.
5 Station closed November 30, 1885.

## APPENDIX 33.

Monthly and annual mean temperature (in degrees Fahrenheit), from reports made by voluntary observers of the Signal Service, United States Army, for the year ending December 31, 1885.

[The daily mean is generally obtained by dividing the sum of the 7 a. m., 2, and twice the 9 p. m. (local time) observations by 4; the monthly, by dividing the sum of the daily by the number of days in the month.]

Stations.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Annual.
cecotink, Va  iken, S. C.  lbany, Oreg.  llison, Kans.  llison, Rans.  llison, Rans.  llison, Rans.  llison, Rans.  llison, Rans.  mherst (agri sta.) Mass.  mherst Mass.  nna. Ill.  nn Arbor, Mich.  rcher, Fla.  abeville, N. C.  ashwood, Tenn.  tchison, Kans.  thens, Ga  uburn, N. Y.  ustin, Tenn.  ustin, Tex.  ainbridge Ialand, Wash.  andon, Oreg.  eloit, Wis.  rd's Nest, Va.  rri's Nest, Va.  rri's Nest, Va.  rri's Nest, Va.  rri's Mass.  ue Lake, Cal.  ooming Grove, Pa.  une Hill, Ill.  marlington, Vt.  arson City, Nev.  arthage, Mo.  stawises, Pa.  dar Rapids, Iowa  hambersburg, Pa.  hapel Hill, N. C.  harleston, Ill.  harlotte, Vt.  lncinnati, Ohio  alv Centre, Kans.  leburne, Tex.  leveland, Ohio  ollege City, Cal.  ollege Hill, Ohio  ollege City, Cal.  ollege Hill, Ohio  ollege City, Cal.  ollege Hill, Ohio  ollege City, Cal.  ollege City, Cal.  ollege Hill, Ohio  ollege City, Cal.	0 43.9.4 44.0 43.9.4 42.7.5 50.1 11.0 50.0 39.4 42.2.5 5.9 50.1 11.0 50.0 34.9 6.0 11.0 6.0 50.0 34.9 6.0 11.0 6.0 50.0 34.9 6.0 11.0 6.0 50.0 50.0 50.0 50.0 50.0 50.0 50.	28.8 44.8 25.7 21.5 25.7 21.6 20 21.3 24.8 8 6 0 341.3 16.5 11.0 20.2 34.8 8 18.8 0 7.2 20.0 19.0 7.2 21.1 22.1 23.1 11.5 20.2 21.5 22.1 23.1 11.5 20.2 21.5 22.1 23.1 11.5 20.2 21.5 22.1 23.1 11.5 20.2 21.5 22.1 23.5 2	o 7. 3 6. 6 1. 1 1. 1 5 2. 6 2. 6 2. 6 2. 6 2. 6 2. 6 2. 6 2.	o 1.55. 8 4 5 5 6 5 6 1 1 4 6 5 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6	65. 22 65. 8 8 61. 4 8 65. 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6	04.(1),9.00.288.5 80.0 40.088.5 80.0 40.08.20.20.20.20.20.20.20.20.20.20.20.20.20.	80.7 (18.4 6 4 4 4 4 7 7 18.5 6 5 (18.4 6 4 9 4 4 7 7 18.5 6 5 (18.4 6 4 9 4 4 7 7 18.5 6 5 (18.4 6 4 9 4 4 7 7 18.5 6 5 (18.4 6 4 9 4 4 7 7 18.5 6 6 6 6 6 7 18.7 18 18 18 18 18 18 18 18 18 18 18 18 18	0 1 (1) 0 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	o 8. 4 (1) 8 (2) 8 (2) 8 (2) 8 (3) 8 (4) 8 (4) 8 (4) 8 (4) 8 (4) 8 (4) 8 (4) 8 (4) 8 (4) 8 (4) 8 (4) 8 (4) 8 (4) 8 (4) 8 (4) 8 (4) 8 (4) 8 (4) 8 (4) 8 (4) 8 (4) 8 (4) 8 (4) 8 (4) 8 (4) 8 (4) 8 (4) 8 (4) 8 (4) 8 (4) 8 (4) 8 (4) 8 (4) 8 (4) 8 (4) 8 (4) 8 (4) 8 (4) 8 (4) 8 (4) 8 (4) 8 (4) 8 (4) 8 (4) 8 (4) 8 (4) 8 (4) 8 (4) 8 (4) 8 (4) 8 (4) 8 (4) 8 (4) 8 (4) 8 (4) 8 (4) 8 (4) 8 (4) 8 (4) 8 (4) 8 (4) 8 (4) 8 (4) 8 (4) 8 (4) 8 (4) 8 (4) 8 (4) 8 (4) 8 (4) 8 (4) 8 (4) 8 (4) 8 (4) 8 (4) 8 (4) 8 (4) 8 (4) 8 (4) 8 (4) 8 (4) 8 (4) 8 (4) 8 (4) 8 (4) 8 (4) 8 (4) 8 (4) 8 (4) 8 (4) 8 (4) 8 (4) 8 (4) 8 (4) 8 (4) 8 (4) 8 (4) 8 (4) 8 (4) 8 (4) 8 (4) 8 (4) 8 (4) 8 (4) 8 (4) 8 (4) 8 (4) 8 (4) 8 (4) 8 (4) 8 (4) 8 (4) 8 (4) 8 (4) 8 (4) 8 (4) 8 (4) 8 (4) 8 (4) 8 (4) 8 (4) 8 (4) 8 (4) 8 (4) 8 (4) 8 (4) 8 (4) 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Monthly and annual mean temperature (in degrees Fahrenheit), fc.—Continued.

Stations.	January.	February.	March.	April.	May.	June.	July,	Augnst.	September	October.	November	December.	Annual.
Porset, Vt	0 19. 2	11.5	19.8	4Î. 1	53. 2	62. 5	68. S	6î. 8	54.8	45. 2	37. e	26.0	4î.
Porset, Vt	28.8	25. 2	25.7	46. 5	55.4	65. 4	71.7	68.0	60.1	47.1	40.8	32.4	47.
Orifton, Pa	24. 1	15. 8		43.8		64.8	(¹)	65. 1	59: 1	48.7 54.5	87.4	28. 1	•••
Oudley, Mass	(¹) 21. 2	(¹) 13. 6	(1) 19, 5	40 6	53.7	(¹) 61. 2	76. 1 69. 2	(¹) 63. 7	63. 0 56. 8	45.6	40. 8 37. 8	29. 1 27. 7	49
aston, Pa	30. 5	25.7	25. 9	(')	61.0	(')	79.8	73.7	67. 9	56.5	48.8	(1)	
oudley, Mass byberry, Pa saston, Pa mbarras, Wis mmittaburg, Md mporia, Kans ola, Orer actoryville, N. Y alrbury, Nebr all Brook, Cal all River, Mass allsington, Pa allston, Md orsyth, Ga ort Scott, Kans ort Wayne, Ind rankfort, Ky rankfort, Ky rankin, Pa	3. 1	6.6	20. 2	41.8	57. 2	64.5	71.8	64.5	60. 9	45, 4	35.7	22.8	
mmittsburg, Md	28. 8	23. 7 22. 9	33.0	(1)	.O.1	69. 2	76. 6	- (2)	64.0	52.0	42.0		
ola Oreg	18. 2 36. 1	46. 5	41.2 52.4	54. 2 52. 3	62. 1 56. 6	59. 3	66. 9	(¹) 66. 2	6L. 0	(1) 55. <b>6</b>	(¹) 45.8	(¹) 43. 9	53
actoryville, N. Y	21. 3	14.8			55. 3	62. 3	60. 8	64. 5	57. 7	48.4	88. 4	29. 4	
airbury, Nebr	(1)	(1)	(1)	(1)	(1)	(9)	88. 3	85, 5	(1)	65. 7	(1)	40.3	
all Brook, Cal.	50.6	53. 9			61.2	65. 4	70. 1	72.5	68. 0	63.0	57.7	54.6	6L
all Kiver, Mass	27. 4 28. 6	(¹) 21. 1	27. 4 29. 1	44. 8 48. 7	52. 0 57. 2	63. 7 68. 8	70. 7 ¹		63. 2 61. 7	52. 1 51. <b>6</b>	43. 7 43. 2	83.4 84.4	49.
allaton, Md	29. 5	23, 8	30. C	50. 0	59. 1	68. 3	74. 6	70.4	63. 2	53. 3	43.7		
orayth, Ga	44.7	44.4	51.7	63. 3	70.4	79.8	82. 3	78.8	74.0	6L.7	54. 9		63
ort Scott, Kans	24. 4	26. 5	43.0			(9)	(1)	(')	(¹)	56. 0	45.6	37.2	- : :
ort wayne, Ind	22. 1 29. 3	19. 0 26. 9	31.0		59. 5	68. 0 72. 1	75. 0 78. 2	69. 0 75. 3	63. 4 66, 5	51. 8 53. 1	43. 0 45. 6	33. 0 36. 4	
ranklin, Pa	18.3	14.0	36.7 19.6	55. 9 39. 6	63. 6 63. 0	53. 2	G6. 4	60. 1	52.6	42. 1	34.5	26. 2	53 40
remont, Nebr	7.4	12. 2	33. 0	47. 6	58. 1		75. 1	68.8	65, 2	47. 0	35. 8	26.3	45
ardiner, Me	19. 2	14.8	20.8	42.0	51.9	62. 1	67. 3	63. 5	55. 7	47.6	38. 6	25. 9	42
arrettsville, Ohio	20. 5	16.7	23.8	43. 5	55. 4	62.6	69. 9	64. 3	57. 6		87. 8	29.4	44.
enoa, Nebr	9. 1 17. 8	14. 1 13. 7	20. 1	48.7 41.2	58. 8 57. 0	68. 9 65. 8	75. 3 72. 1	68. 5 66. 6	63. 5 59. 9	48.0 44.4	37. 1 33. 8	29. 5 24. 2	46 43
rampian Hills, Parand Coteau, La	51.1		59. 4	71.5	74.7	81.6	82.7	82. 0	77. 3	65. 7	60. 1	54.4	67.
reat Falls Reservoir, Md	31.8	27.0	33. 9	53. 6	63. 8	72.5	78.4	74.4	66. 6	54. 0	44.0	35. 3	52
reensborough, Ala	89. 2	44.9	51.1	65. 7	69. 3	79.0	78.9	(1)	75. 8	61.5	55. 1	47.5	
reen Springs, Alauilford, Ind	43. 2 (¹)	43. 4 22. 1	48. 2 32. 7	66. 7 48. 9		80. 0 66. R	80.4 77.2	80. 2 70. 5	64.6	(¹) 51. 2	(¹) 40. 4	(¹) 31. 9	
uttenberg, Iowa	5. 2	7. 0	25. 3	44. 2	55. 1		71. 2	65. 3	59. 8	46. 0	(1)	18.3	•••
artford, Conn	25. 9	18.0	26.7	46. 8	56.8		71. 2 71. 2 69. 5	65. 7	57. 2	48. 2	40.4		46.
elvetia, W. Va	30.7	25.7	32.6	47.3	56.4	65. 7	69. 5	67.2	59. 9		89.6	30. 9 34. 4	48
iram, Ohio	19. 2 13. 9	15. 2 16. 1	23. 1 20. 6	45. 3	58.7	64. 3 60. 2	73. 1	66. 1 63. 1	60.6	48. 4 45. 0	88, 7	28. 9	45.
umboldt Town	3. 3	4. 2	(1)	42.3 45.5	52. 5 56. 0	67. 5	73. 4 72. 0	63. 5	60.0	43.7	(¹) 33. 5	23.6	• • •
uilford, Ind  uttenberg, Iowa lartford, Conn elvetia, W. Va liram, Ohio ludson, Mich lumboldt, Iowa lumphrey, N. Y lydesville, Cal ndependence, Iowa legendence, Caya	16.1	4. 2 14. 1	18.1	39. 2	55. 2	62. 2	74. 9	64.3	58. 2	47. 2	85. 1	25. 2	42
ydesville, Cal	48.8	50.3	51.7	52.5	0.	56. 9	(1)	0	(1)	(b)	(1)	(1)	
ndependence, lows	5. 2 20. 0	9.1	27.6		56.8		73. 7	65. 8	60. 8		35. 6	23.2	42
ndependence, Kans	32. 0	25. 2 19. 0	43. 1 37. 2		63. 2	72. 9 69. 5	78. 2 74. 7	74. 8 73. 8	67. 8 51. 0	54. 4 50. 0	47. 9 (¹)	36.3 (¹)	53.
ndianola, Iowa	8.8		82. 2	47. 8	59. 1	(')	(i)	62. 9	61.7	46. 3	~ii	65	
ndependence, Mo	21.5	15. 3	21.4	41.6	55.4	64. 8	71. 3	64. 6	57. 9	48. 5	39. 4	29. 8	44.
acksonborough, Ohio	21. 1				61.8	70. 7	79. 7	71.4	64. 0	50.7	41.1	81. 1	49.
effersonville, Ind	26. 9 26. 5		36. 4    (¹)	55. 0 (¹)	64. 3 63. 7	70. 3 72. 8	78. 2 78. 6	80. 0 75. 0	66. 4 66. 7	52. 5 52. 6	45. 1 45. 6	36. 2 35. 0	53.
afavette. Ind	17. 6		29, 6	49. 2		68. 4	75. 5	68. 3	63. 2		39. 8	28.7	
a Grange, Ind	17.7	11.8	23, 4		57. 5	(¹)	(1)	65. 5	(1)	(1)	38. 5	27. 9	
ansing, Mich	15.8			44.0		65. 3		63, 3	55. 9	45.4	38. 2	27. 1	
awrence, Kans	18.7 28.8	20. 8 32. 2	40.6		(1)	72. 0 80. 2	77. 1 82. 7	(1)	(¹) 70. 0	51.2	(¹) 49. 8	32.5	
aicester Mass	21.5					63, 1	(1)	78. 4 65. 2	56. 9	56. U 48. 4	(1)	39. 0 27. 5	31.
effersonville, Ind aconia, Ind aconia, Ind a Grange, Ind a Grange, Ind a Grange, Ind awrence, Kans ead Hill, Ark eleoster, Mass o Roy, N. Y berty Hill, La incolnton, N. C ogan, Iows ogan, Iows unenburg, Vt adison, Nor	20. 9	15. 1	21.8		57.4	64.5	71. 3	68. 9	59.8	49. 0	39. 8	28.8	45.
iberty Hill, La	(¹)	(1)	61. 1	72. 7	76.7	86. 3	87. 0	85. 9	78. 5	66. 7	60. 5	54.5	
imona, Fia	60. 3 35. 0	59. 8 38. 1	64. 4 40. 7		77.0 64.2	81.7 73.6	80. 9 74. 1	82. 9 76. 0	79. 4 67. 8	70. 2 52. 8	63. 3 45. 5	58. 3 38. 2	70.
ngan Towa	(¹)	15.5	32.5		61.7	71.8	76. 9	70.4	65, 2	(1)	89. 6	25. 6	
ogansport, Ind	ìś. 6	18.1	29. 6	51.2	61.4		77. 6	70.4	66.1	51.3	44.5	81.6	49.
uling, La	(1)	(1)	(0.1	69. 0		(1)	(1)	(4)	75. 8	62. 3	(1)	50. 2	
unenburg, Vt	15. 4 9. 6	8.8			54.9	61. 7 67. 6	66. 2 73. 2	61.4	53. 3 (¹)	45.7	<b>35.</b> 6	23.0	40.
adison, Wis	7. 0	13. 1 8. 2	32.3	47. 4 42. 0	55.9 51.8	(1)	75. 2	66. 1 64. 2	59. 9	(¹) 44. 8	35. 8	28.3 23.7	•••
ahanoy Plane, Pa	(1)	(i)	27. 9 65. 2	49.8	61. 2	70.0	77. 6	70.2	64. 2 81. 8	52.1 72.6	41.6	33.9	• • •
anatee, Fla	04 1			74.4	77. 8	81.7	00 0	84.4	81.8	72.6			72
anchester, Iowa	8.0	10.5	28.5	46.4	59. 0	68. 0	75.6	67. 0	62.0	47.0	87. 0	23.5	44
anhattan (B), Kans	10.3	6. S	12 0	35 9	49 9	56 0	64 2	50 0	55 9	42 7	25.0	23. 5 31. 7 25. 7 26. 5 49. 5 35. 0	9L
anistique, Mich	8.7	11.0	23. 2	89. 3	50. 3	57. 8	67. 7	64.4	60. 1	45. 4	38. 2	26.5	41
[arietta, Cal [arion, Va	(1)	(1)	(4)	(1)	(1)	(1)	70. 9	75. 8	67.5	61. 2	54.5	49.5	
farion, Va	32.0	28.0	34. 3	51.6	60. 0	71.0	73. 0	70.6	63. 9	50. 5	43.2	35. 0	5L.
larquette, Nebr	(i)	(')	(;),	(')	(1)	(¹)	80. 1	(¹)	(')	55.7	(')	36. 8	Eå
and Kana	19.31	25.7	42.5	58. 9	64 8	76.5	88. KI	80.04	(1)	(1)	111	34.0	<b>50</b> .
lauzy, Ind	18. 2	(1)	(1)	53. 1	58. 9	67. 3	73. 4	67. 2	64. 8	44.6	37. d	~장 [	· · · ·
larion, Va Larquette, Nebr Lattoon, Ill Laud, Kans Lauzy, Ind Laynard, Iowa Laynard, Iowa Laynort, Fla Lasatlan, Mexico	(9)	14. 1	21. 2	40.4	51.5	62. 3	69. 7	62. 1	(9)	(1)	<b>@</b> ]	35. 0 36. 8 33. 0 () () () () 75. 8	
ayport, Fla	59. 1	56.3	59. 9	69. 1	74.1	80. 1	80.7	81.0	80.4	71.7	0	(t)	
BERLIED, MOYICO	MU ()									·/u 1!	.77		77

### Monthly and annual mean temperature (in degrees Fahrenheit), &c.-Continued.

Stations.	January.	February.	March,	April.	Mas.	June.	July.	Angust.	September	October.	November.	December.	Annwal
fcDonogh, Md fenand Station, N. Y fendon, Mass ferritt's Island, Fla filan, Tonn	26. 7 20. 8 23. 6 (1) 32. 0	35. 8 13. 8 16. 6 (¹) 33. 8	81. 7 22. 5 25. 6 (1) 43. 7	51. 9 45. 5 48. 5 (1) 60. 2	61. 1 57. 6 56. 6 (¹) 64. 9	70. 4 66.2 67. 4 78. 5 75. 4	76. 3 72. 7 71. 0 80. 1 78. 0	71. 1 66. 5 66. 2 80. 6 76. 9	03. 2 58. 9 58. 2 79. 4 70. 3	53. 2 49. 3 53. 4 73. 1 55. 2	43. 4 39. 7 41. 1 59. 9	34. 2 29. 1 29. 3 58. 0 39. 7	
filledgewille Co	44.0 (') 0.8 5.9	42. 4 19. 3 6. 0 8. 7	49. 8 (1) 23. 7 27. 2	63. 3 45. 1 43. 4 45. 2	69. 9 52. 1 55. 6 56. 8	79. 2 65. 2 65. 3 67. 3	80. 6 71. 0 72. 6 74. 4	79. 8 65. 3 63. 8 65. 8	75. 3 52. 7 59. 1 60. 5	60. 8 (1) 42. 5 45. 4	48. 6 (1) 42. 4 32. 5 35. 2	(1) 32. 6 20. 5 22. 6	40
liiton, Mass linnespolis, Minn lonticello, Iowa loorestown, Mich loorestown, N. J lountainville, N. Y Lount Forest, Canada	11. 8 28. 9 26. 6	5. 6 21. 6 18. 9 28. 5	14. 3 29. 7 25. 3	37. 1 49. 1	78. 2 (¹) 56. 3 48. 0	51. 1 69. 3 67. 0	( ¹ ) 74. 8 72. 4 67. 2	(¹) (¹) 67. 5 61. 0	(¹) (¹) 60. 1 55. 0	(¹) 51. 9 49. 8 (¹)	(1) 43. 0 40. 4 40. 0	(¹) 34. 6 32. 1	47
Iount Ida, Ark Iount Vernon, Iowa Inscatine, Iowa eillsville, Wis	(') 6. 9 11. 1 —6. 3	88. 7 (¹) 10. 4 —1. 6	48. 4 29. 4 81. 0 15. 0	63. 0 48. 0 47. 6	64. 0 62. 0 66. 9 46. 5	74. 5 71. 6 68. 2 59. 7	77. 7 (¹) 76. 5 65. 5	73. 3 (¹) 68. 8 56. 3	71. 5 (¹) 65. 0 51. 9	59. 5 48. 1 47. 6 38. 3		42.0 25.6 19.7	4:
ephi, Utahew Bedford, Massewport, Vtew Ulm, Tex	23, 1 27, 5 15, 8 (¹)	31. 8 20. 4 7. 5	41.7 27.7 16.0 58.0	45. 4 41. 1 69. 3	53. 0 52. 9 57. 0 72. 0	61. 0 63. 7 64. 0 81. 2	72. 2 70. 4 69. 0 81. 5	68. 9 67. 1 63. 3 83. 6	(1) 58. 8 55. 6 77. 8	(¹) 51. 3 45. 7 66. 4	(1) 44. 1 34. 9 61. 2	(1) 82. 9 20. 4 54. 4	40
orth Colebrook, Conn	20. 6 2. 3 22. 4 19. 7	14. 5 6. 5 19. 5 12. 4	17. 5 24. 7 80. 1 18. 6	43. 6 49. 3 39. 2	53. 2 55. 6 62. 1 54. 9	64. 7 65. 7 69. 4 62. 2	69. 7	67. 5 63. 8 74. 1 63. 2	61. 0 59. 7 64. 8 57. 9	46.7	41,0 33.2 40.2 89.2	25. 7 22. 0 31. 7 27. 7	4
akland, Cal rono, Me roville, Cal akaloosa, Iowa ttnmwa Iowa	49. 7 16. 0 (¹) (¹)	54. 1 13. 3 (¹) (¹)	56. 9 19. 2 68. 2 (¹)	40. 8 64. 8 (¹)	59. 0 51. 9 72. 1 (¹)	59. 7 61. 8 73. 0 (¹)	78.9	61. 0 63. 3 82. 1 66. 9	61. 9 54. 4 76. 1 62. 0	59. 9 46. 5 69. 2 44. 9	56. 8 86. 4 57. 1 (¹)	52, 4 25, 0 53, 0 24, 1	4
acolet, S. C	12. 9 87. 6 17. 7	15. 8 85. 8 9. 8	82. 2 44. 1 17. 1	48. 7 69. 6 88. 0	60, 5 67, 5 54, 0	66. 7 75. 5 61. 1	77. 1 78. 8 67. 5	70. 3 76. 5 61. 6	64. 3 70. 9 56. 4	56. 2 46. 1	(¹) 47. 8 36. 7	(1) 40. 7 25. 6	4
South America aterson, N. J coria, III hillipsburg, N. J cierce City, Mo cont Pleasant, La	77. 0 30. 0 16. 8 29. 4	77. 8 23. 0 15. 9 21. 9	78. 4 (¹) 84. 1 81. 3	78.3 47.0 51.7	78. 4 ( ¹ ) 63. 6 55. 3	77. 6 67. 1 73. 2 61. 5	78. 5 (1) 81. 2 76. 0	79. 9 71. 0 73. 2 71. 4	80. 3 ( ¹ ) 66. 6 ( ¹ )	81. 3 (1) 52. 3 (1)	81. 3 (¹) 42. 8 (¹)	78. 4 83. 5 81. 2 81. 8	5
ort Will Village Vt	24. 8 42. 6 29. 2	27. 5 45. 0 26. 1	15. 2	52. 6 41. 2	62. 0 70. 2 62. 0 56. 8	71. 1 83. 5 69. 0 65. 5	64.5	79. 5 71. 9 61. 1	67. 5 73. 0 63. 6 55. 7	44.1	41.7 33.7	48. 5 85. 8 19. 5	5
rairie du Chien, Wisrinceton, Cal	49. 4 7. 2 48. 1 (1)	52. 0 9. 0 54. 4 13. 8	57.3 27.3 62.8 21.0	45, 0 62, 3 43, 3	63. 3 56. 5 69. 5 52. 1	65, 2 69, 4 69, 8 62, 1	70. 8 74. 5 76. 7 68. 5	75. 8 66. 4 79. 6 62. 9	69, 3 61, 4 73, 6 56, 0	63. 4 45. 5 (¹) 47. 4	36. 6 (¹) 37. 5	49. 0 27. 0	4
rinceton, Mass rinceton, N. J rovidence, R. I ueblo, Colo uerto de Luna, N. Mex uakertown, Pa aleigh, N. U eadington, N. J cociving Reservoir, D. C lehmand, K.v.	(1) 30. 5 23. 3 31. 5	(1) 22.0 31.2 39.4	20. 2 26. 4 41. 3 47. 4	57.4	58. 2 53. 6 57. 0 62. 8	70. 1 65. 8 70. 7 74. 4	75. 9 (¹) 74. 9 79. 1	71. 2 (') 71. 1 76. 0	63. 8 (1) (1) 67. 7	53. 4 (1) 50. 2 54. 9	(¹) 42, 4 49, 5	34. 2 (1) 34. 7 41. 0	5
uakertown, 1'a aleigh, N. U eadington, N. J occiving Reservoir, D. C	27. 4 40. 0 33. 7 31. 4	19. 8 (¹) 26. 8 28. 8	26. 4 (¹) (¹) 34. 2	45. 1 60. 0 52. 8 54. 5	55. 4 76. 0 62. 9 65. 3	77. 1 78. 0 73. 9 74. 2	72. 0 80. 0 80. 3 80. 7	67. 4 79. 0 74. 7 76. 2	(1) (8, 0 68, 0	49. 0 59. 0 58. 2 55. 9	59. 5 47. 5 45. 6	30. 7 44. 0 39. 3 36. 8	5
I TI	0. 4 29. 5 8. 8 35. 1	2. 6 26. 9 7. 7 30. 1	25. 6 36. 0 24. 8 37. 5 26. 8	55. 5 42. 2 57. 8	47. 7 63. 4 54. 4 67. 9	60. 4 71. 8 64. 7 77. 3	68. 2 (1) 71. 8 83. 1	61. 6 74. 8 64. 1 78. 1	57. 1 66. 8 59. 8 69. 6	48. 9 52. 7 44. 8 59. 1	44. 4 35. 8 48. 8	24. 2 85. 8 23. 2 39. 9	4 5
nley, 11 cock Creok Bridge, D. C cock Grook, III cowe, Mass. uggles, Ohio ceramento, Cal alem, N. J	11. 2 17. 9 20. 7 46. 4 33. 1	7. 6 11. 2 16. 5 53. 3 26. 9	18. 4 26. 2 58. 5 33. 0	43. 7 41. 3 44. 8 60. 0 51. 7	55. 9 52. 5 56. 5 65. 6	65.9 63.2 62.7 67.0	72. 5 67. 9 71. 3 70. 6	65. 3 62. 2 64. 4 71. 5	60. 7 55. 2 59. 0 67. 3		36. 9 35. 8 31. 6 54. 4	24. 2 (¹) 31. 2 50. 0	: <u>:</u>
aline, Kausalinas City, Calandwich, Ill	20. 7 48. 7	26. 2 50. 3	(¹) 55. 1	55. 4 56. 5	63. 3 66. 1 57. 9 58. 6	73. 1 76. 0 56. 4 69. 0		75. 4 75. 2 58. 9 68. 7	(1) 69, 0 58, 9 63, 9			(1) 35. 0 52. 0 26. 1	5
herlock, Kans	27. 2 28. 2 26. 9	19. 6 21. 6 20. 1	28. 2 29. 0 27. 6	55. 3 44. 1 49. 1 48. 0	56. 6 58. 2 58. 1	69. 1 71. 0 69. 9	75. 6 75. 7 72. 5	71. 2 71. 2 69. 2	61. 5 63 5 62. 4	53. 4 51. 8 51. 0	44. 6 44. 8 42. 9 41. 9	35. 1 33. 0 33. 9	4
outhington, Conn outh Orange, N. J piceland, Ind	24. 6 28. 8 19. 9 29. 1	17. 5 22. 8 17. 6 27. 4	25. 9 28. 9 30. 1	49. 1 48. 0 43. 0 46. 7 48. 0 49. 9 56. 9 62. 2 60. 0 54. 1 (1)	56. 0 57. 3 60. 1	68. 2 68. 5	73. 0 73. 4 76. 1	(1) (6, 8 68, 7 (8, 7)	(1) 58, 5 62, 0 63, 2	(1) 49, 2 52, 2 48, 8	37. 0 40. 5 44. 5 42. 0	25. 4 31. 0 35. 5 30. 8	4
pringueld, inc. inteburg, S. C. satesville, N. C. terling, Kans. tockham, Nebr.	46. 0 39. 0	40. 0 36. 6	48. 3 45.7	62. 2 60. 0	65. 9 68. 9	76. 4 78. 4	78.3 80.4	78. 2 78. 2	07. 6 71. 8 70. 6	(¹) 59. 8 57. 0	41. 6 52. 9	38.0 45.9 42.1	6

# Monthly and annual mean temperature (in degrees Fahrenheit), &c.—Continued.

Strafford, Vt.	Stations.	January.	February.	March.	April.	May.	Jane.	July	August.	September.	October.	November.	December.	Annual.
Voodstock, Vt	unman, Ind.  unsex, Wis.  wanwick, Ill  wartz Creek, Mich  yeamore, Ill  acoma, Wash  'allahassee, Fla.  'aunton, Mass.  ecumseh, Nebr.  hornville, Mich.  'iffin, Ohlo  opeka, Kans.  roy, P.  ariety Mills, Va.  ermillion, Dak  evay, Ind  'ineland, N. J.  Vabash, Ind.  Vashington City  Vaterville, Me.  Vanseu, Wis.  Vanseu, Wis.  Vanseu, Ohio  Vebster, Dak  Veldon, N. C.  Vellington, Kans  Vest Loavenworth, Kans  Vest Cheeter, Pa.  Vest Cheeter, Pa.  Vest Leavenworth, Kans  Vest Loavenworth, Kans  Vest Lonon, Iowa  Vitte Plains, N. Y  Villesbarre, Pa.  Villesbarre, Pa.  Villesbarre, Pa.  Villesbarre, Pa.  Villesbarre, Pa.	o 1. 7. 8. 11. 8. 6. 11. 8. 6. 11. 8. 6. 11. 8. 6. 11. 8. 6. 11. 8. 6. 11. 8. 6. 11. 8. 6. 11. 8. 6. 11. 8. 6. 11. 8. 6. 11. 8. 6. 11. 8. 6. 11. 8. 6. 11. 8. 6. 11. 8. 6. 11. 8. 6. 11. 8. 6. 11. 8. 6. 11. 8. 6. 11. 8. 6. 11. 8. 6. 11. 8. 6. 11. 8. 6. 11. 8. 6. 11. 8. 6. 11. 8. 6. 11. 8. 6. 11. 8. 6. 11. 8. 6. 11. 8. 6. 11. 8. 6. 11. 8. 6. 11. 8. 6. 11. 8. 6. 11. 8. 6. 11. 8. 6. 11. 8. 6. 11. 8. 6. 11. 8. 6. 11. 8. 6. 11. 8. 6. 11. 8. 6. 11. 8. 6. 11. 8. 6. 11. 8. 6. 11. 8. 6. 11. 8. 6. 11. 8. 6. 11. 8. 6. 11. 8. 6. 11. 8. 6. 11. 8. 6. 11. 8. 6. 11. 8. 6. 11. 8. 6. 11. 8. 6. 11. 8. 6. 11. 8. 6. 11. 8. 6. 11. 8. 6. 11. 8. 6. 11. 8. 6. 11. 8. 6. 11. 8. 6. 11. 8. 6. 11. 8. 6. 11. 8. 6. 11. 8. 6. 11. 8. 6. 11. 8. 6. 11. 8. 6. 11. 8. 6. 11. 8. 6. 11. 8. 6. 11. 8. 6. 11. 8. 6. 11. 8. 6. 11. 8. 6. 11. 8. 6. 11. 8. 6. 11. 8. 6. 11. 8. 6. 11. 8. 6. 11. 8. 6. 11. 8. 6. 11. 8. 6. 11. 8. 6. 11. 8. 6. 11. 8. 6. 11. 8. 6. 11. 8. 6. 11. 8. 6. 11. 8. 6. 11. 8. 6. 11. 8. 6. 11. 8. 6. 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72.4 6 72.4 6 72.4 6 72.4 6 72.4 6 72.4 6 72.4 6 72.4 6 72.4 6 72.4 6 72.4 6 72.4 6 72.4 6 72.4 6 72.4 6 72.4 6 72.4 6 72.4 6 72.4 6 72.4 6 72.4 6 72.4 6 72.4 6 72.4 6 72.4 6 72.4 6 72.4 6 72.4 6 72.4 6 72.4 6 72.4 6 72.4 6 72.4 6 72.4 6 72.4 6 72.4 6 72.4 6 72.4 6 72.4 6 72.4 6 72.4 6 72.4 6 72.4 6 72.4 6 72.4 6 72.4 6 72.4 6 72.4 6 72.4 6 72.4 6 72.4 6 72.4 6 72.4 6 72.4 6 72.4 6 72.4 6 72.4 6 72.4 6 72.4 6 72.4 6 72.4 6 72.4 6 72.4 6 72.4 6 72.4 6 72.4 6 72.4 6 72.4 6 72.4 6 72.4 6 72.4 6 72.4 6 72.4 6 72.4 6 72.4 6 72.4 6 72.4 6 72.4 6 72.4 6 72.4 6 72.4 6 72.4 6 72.4 6 72.4 6 72.4 6 72.4 6 72.4 6 72.4 6 72.4 6 72.4 6 72.4 6 72.4 6 72.4 6 72.4 6 72.4 6 72.4 6 72.4 6 72.4 6 72.4 6 72.4 6 72.4 6 72.4 6 72.4 6 72.4 6 72.4 6 72.4 6 72.4 6 72.4 6 72.4 6 72.4 6 72.4 6 72.4 6 72.4 6 72.4 6 72.4 6 72.4 6 72.4 6 72.4 6 72.4 6 72.4 6 72.4 6 72.4 6 72.4 6 72.4 6 72.4 6 72.4 6 72.4 6 72.4 6 72.4 6 72.4 6 72.4 6 72.4 6 72.4 6 72.4 6 72.4 6 72.4 6 72.4 6 72.4 6 72.4 6 72.4 6 72.4 6 72.4 6 72.4 6 72.4 6 72.4 6 72.4 6 72.4 6 72.4 6 72.4 6 72.4 6 72.4 6 72.4 6 72.4 6 72.4 6 72.4 6 72.4 6 72.4 6 72.4 6 72.4 6 72.4 6 72.4 6 72.4 6 72.4 6 72.4 6 72.4 6 72.4 6 72.4 6 72.4 6 72.4 6 72.4 6 72.4 6 72.4 6 72.4 6 72.4 6 72.4 6 72.4 6 72.4 6 72.4 6 72.4 6 72.4 6 72.4 6 72.4 6 72.4 6 72.4 6 72.4 6 72.4 6 72.4 6 72.4 6 72.4 6 72.4 6 72.4 6 72.4 6 72.4 6 72.4 6 72.4 6 72.4 6 72.4 6 72.4 6 72.4 6 72.4 6 72.4 6 72.4 6 72.4 6 72.4 6 72.4 6 72.4 6 72.4 6 72.4 6 72.4 6 72.4 6 72.4 6 72.4 6 72.4 6 72.4 6 72.4 6 72.4 6 72.4	0 6 6 77.8 8 71.0 6 6 4 8 8 71.1 6 6 6 4 8 8 71.5 2 0 78.8 9 71.5 2 0 78.8 9 71.5 2 0 78.8 9 71.5 2 0 78.8 9 71.5 2 0 78.8 9 71.5 2 0 78.8 9 71.5 2 0 78.8 9 71.5 2 0 78.8 9 71.5 2 0 78.8 9 71.5 2 0 78.8 9 71.5 2 0 78.8 9 71.5 2 0 78.8 9 71.5 2 0 78.8 9 71.5 2 0 78.8 9 71.5 2 0 78.8 9 71.5 2 0 78.8 9 71.5 2 0 78.8 9 71.5 2 0 78.8 9 71.5 2 0 78.8 9 71.5 2 0 78.8 9 71.5 2 0 78.8 9 71.5 2 0 78.8 9 71.5 2 0 78.8 9 71.5 2 0 78.8 9 71.5 2 0 78.8 9 71.5 2 0 78.8 9 71.5 2 0 78.8 9 71.5 2 0 78.8 9 71.5 2 0 78.8 9 71.5 2 0 78.8 9 71.5 2 0 78.8 9 71.5 2 0 78.8 9 71.5 2 0 78.8 9 71.5 2 0 78.8 9 71.5 2 0 78.8 9 71.5 2 0 78.8 9 71.5 2 0 78.8 9 71.5 2 0 78.8 9 71.5 2 0 78.8 9 71.5 2 0 78.8 9 71.5 2 0 78.8 9 71.5 2 0 78.8 9 71.5 2 0 78.8 9 71.5 2 0 78.8 9 71.5 2 0 78.8 9 71.5 2 0 78.8 9 71.5 2 0 78.8 9 71.5 2 0 78.8 9 71.5 2 0 78.8 9 71.5 2 0 78.8 9 71.5 2 0 78.8 9 71.5 2 0 78.8 9 71.5 2 0 78.8 9 71.5 2 0 78.8 9 71.5 2 0 78.8 9 71.5 2 0 78.8 9 71.5 2 0 78.8 9 71.5 2 0 78.8 9 71.5 2 0 78.8 9 71.5 2 0 78.8 9 71.5 2 0 78.8 9 71.5 2 0 78.8 9 71.5 2 0 78.8 9 71.5 2 0 78.8 9 71.5 2 0 78.8 9 71.5 2 0 78.8 9 71.5 2 0 78.8 9 71.5 2 0 78.8 9 71.5 2 0 78.8 9 71.5 2 0 78.8 9 71.5 2 0 78.8 9 71.5 2 0 78.8 9 71.5 2 0 78.8 9 71.5 2 0 78.8 9 71.5 2 0 78.8 9 71.5 2 0 78.8 9 71.5 2 0 78.8 9 71.5 2 0 78.8 9 71.5 2 0 78.8 9 71.5 2 0 78.8 9 71.5 2 0 78.8 9 71.5 2 0 78.8 9 71.5 2 0 78.8 9 71.5 2 0 78.8 9 71.5 2 0 78.8 9 71.5 2 0 78.8 9 71.5 2 0 78.8 9 71.5 2 0 78.8 9 71.5 2 0 78.8 9 71.5 2 0 78.8 9 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55.3 8 7 55.3 8 7 55.3 8 7 55.3 8 7 55.3 8 7 55.3 8 7 55.3 8 7 55.3 8 7 55.3 8 7 55.3 8 7 55.3 8 7 55.3 8 7 55.3 8 7 55.3 8 7 55.3 8 7 55.3 8 7 55.3 8 7 55.3 8 7 55.3 8 7 55.3 8 7 55.3 8 7 55.3 8 7 55.3 8 7 55.3 8 7 55.3 8 7 55.3 8 7 55.3 8 7 55.3 8 7 55.3 8 7 55.3 8 7 55.3 8 7 55.3 8 7 55.3 8 7 55.3 8 7 55.3 8 7 55.3 8 7 55.3 8 7 55.3 8 7 55.3 8 7 55.3 8 7 55.3 8 7 55.3 8 7 55.3 8 7 55.3 8 7 55.3 8 7 55.3 8 7 55.3 8 7 55.3 8 7 55.3 8 7 55.3 8 7 55.3 8 7 55.3 8 7 55.3 8 7 55.3 8 7 55.3 8 7 55.3 8 7 55.3 8 7 55.3 8 7 55.3 8 7 55.3 8 7 55.3 8 7 55.3 8 7 55.3 8 7 55.3 8 7 55.3 8 7 55.3 8 7 55.3 8 7 55.3 8 7 55.3 8 7 55.3 8 7 55.3 8 7 55.3 8 7 55.3 8 7 55.3 8 7 55.3 8 7 55.3 8 7 55.3 8 7 55.3 8 7 55.3 8 7 55.3 8 7 55.3 8 7 55.3 8 7 55.3 8 7 55.3 8 7 55.3 8 7 55.3 8 7 55.3 8 7 55.3 8 7 55.3 8 7 55.3 8 7 55.3 8 7 55.3 8 7 55.3 8 7 55.3 8 7 55.3 8 7 55.3 8 7 55.3 8 7 55.3 8 7 55.3 8 7 55.3 8 7 55.3 8 7 55.3 8 7 55.3 8 7 55.3 8 7 55.3 8 7 55.3 8 7 55.3 8 7 55.3 8 7 55.3 8 7 55.3 8 7 55.3 8 7 55.3 8 7 55.3 8 7 55.3 8 7 55.3 8 7 55.3 8 7 55.3 8 7 55.3 8 7 55.3 8 7 55.3 8 7 55.3 8 7 55.3 8 7 55.3 8 7 55.3 8 7 55.3 8 7 55.3 8 7 55.3 8 7 55.3 8 7 55.3 8 7 55.3 8 7 55.3 8 7 55.3 8 7 55.3 8 7 55.3 8 7 55.3 8 7 55.3 8 7 55.3 8 7 55.3 8 7 55.3 8 7 55.3 8 7 55.3 8 7 55.3 8 7 55.3 8 7 55.3 8 7 55.3 8 7 55.3 8 7 55.3 8 7 55.3 8 7 55.3 8 7 55.3 8 7 55.3 8 7 55.3 8 7 55.3 8 7 55.3 8 7 55.3 8 7 55.3 8 7 55.3 8 7 55.3 8 7 55.3 8 7 55.3 8 7 55.3 8 7 55.3 8 7 55.3 8 7 55.3 8 7 55.3 8 7 55.3 8 7 55.3 8 7 55.3 8 7 55.3 8 7 55.3 8 7 55.3 8 7 55.3 8 7 55.3 8 7 55.3 8 7 55.3 8 7 55.3 8 7 55.3 8 7 55.3 8 7 55.3 8 7 55.3 8 7 55.3 8 7 55.3 8 7 55.3 8 7 55.3 8 7 55.3 8 7 55.3 8 7 55.3 8 7 55.3 8 7 55.3 8 7	7.744.44.0(-)(-)7.606.5004.388.38.45.0.507.742.81.42.21.45.61.10.9337.0.11	22.55.59 (1) (1) 27.7 23.9 41.4 7 23.3 20.4 41.4 7 23.3 20.4 41.4 7 23.3 20.4 41.4 7 23.3 20.5 22.2 22.2 23.2 23.2 23.2 23.2 23.2 23	0 42 53 50 47.4 44.6 52 44.6 52 45.7 52 45.4 42.6 45.4 47.4 46.4 46.4 46.4 46.4 46.4 46.4 46

¹ No record.



#### APPENDIX 34.

Monthly maximum and minimum temperatures and annual range of temperature (in de-States Army, for the year end-[From self-register-

February. March. April. May. January. June Stations. Min. Max. Min. Max. Min. Max. Min. Max. Min. Max. Min. 0 8 19 66 53 3 72 10 92 30 91 98 (1) 82 99 90 89 59(1)551235194275762555459659(1)435841422894123644265638443255614555045544288941236442656384432556145550 74 64 67 13 71 75 28 37 99 49 88 24 27. 5 87 62 34 32 80 37 59 57 57 77 61. 50 70 20 14 82 30 90 30 Allison, Kans
Altoons, Pa
Amherst (agri. sts.), Mass
Amherst, Mass
Anna, Ill
Ann Arbor, Mich -11 - 3 13 34 21 -18 40. 1 83 83 21 19 39 - 15 85 58 63 44. 81 - 8 -12 - 8 - 6 83 22 33 3i 41 60 46 79 (48 53 66 42 69 77 58 (1) 48 49 54 79 76 76 76 70 76 76 76 76 76 32 81 -23 32 (¹) -17 31 19 47 Ann Arlsor, Mich
Archer, Fla
Asheville, N. C
Ashwood, Tenn
Atchison, Kans
Atchens, Ga
Auburn, N. Y
Austin, Tenn
Austin, Tex
Bainbridge Island, Wash
Bandon, Oreg
Beloit, Wis
Bird'a Nest, Va
Birmingham, Ala Ğ 80 90 82 81 77 85 28 56 39 43 6 40 29 37 () 34 () 25 3 42 23 1 52 4 4 28 28 4 34 4 4 () 28 3 4 4 4 4 () 28 3 4 4 4 4 () 28 83 16 16 17 20 10 41 33 20 10 2 -12 28 34 80 20 35 56 30 (') 22 37 62 66 44 60 51 62 78 58 40 70 16 7 · 8 3 24 31 (¹) -24 11 10 (¹) -10 - 3 2 83 81 85 78 (1) 70 zero. 24 28 29 -24 16 (¹) (¹) - 3 15 21 82 88 Birmingham, Ala Birmingham, Mich (1) (1) (1) (2) (1) (1) (1) 34 16 24 24 26 -13 -10 - 0. 6 79 Birmingham, Mich...

Blue Hill, Mass...

Blue Lake, Cal...

Boyne, Mich...

Brattleborough, Vt...

Bunker Hill, Ill...

Burlington, Vt...

Carson City, Nov...

Carthage, Mo...

Cattawissa, Pa...

Gedar Randis, Iowa... 88 zero. (¹) 27 79 77 82 84 81 85 80 (¹) -13 -18 17 66 (1) (1) 60 88 83 -34 (¹) 11 -17 (¹) (¹) 60 53. 8 zero 22 24 14 28 38 (†) (†) 19 14.8 20 20 15 65 77 86 86 74 (¹) 91 93 99 99 90 91 92 93 96 96 99 66 17 30 (1) 2 14 (1) -16 62 - 0. - 2 (¹) 8 17 48 44 (1) 46 68 -11 24 16 (¹) 27 29 29 16 Catawissa, Pa.
Cedar Rapida, Iowa
Controvillo, Mo.
Chambersburg, Pa.
Chapel Hill, N. C.
Charleston, Ill
Charlotto, Vt.
Checter, Minn.
Cincinnati Obio 28 (1) 42 (1) 54 77 (1) 50 35 62 57 69 ~`4 9 94 79 90 86 84 85 89 50 35 29 21 41 34 4 14 60 40 89 58 61 zero. -20 -30 85 73 85 80 -53 -10 14 30 30 -16 Cincinnati, Ohio ...... ٠ ۵ 5 12 84 90 82 80 109 Clay Centre, Kans
Cloburne, Tex
Cleveland, Ohio -2ĭ 4 -0. 8 72 46 (1) 75 52 63 47 43 8 26 88 42 23 (¹) 40 27 28 23 20 15 46 93 83 90 102 53. 5 - 5 (¹) 37 3 12 84 (1) 95 82 75 87 82 80 (1) 72 30 Cleveland, Ohio.
Clyde, Ohio
College City, Cal
College Hill, Ohio
College Hill, Ohio
Collinsville, III
Conception, Mo
Contoecook, N. II
Cooperatown, N. Y.
Cornish Ma -15 85 -15 -11 (1) 67 48 62 (¹) 34 40 50 40 35 29 92 97 91 87 -12 -13 51 47 42 90 .16 49 -21 23 83 87 81 83 (¹)  $\frac{55}{27}$ 61 - 19 -10 90 83 88 98 30 32 () 27 58 46 (¹) 34 57 12 38 41 (¹) 37 -12 -14 44 45 76 42 47 Cornish, Me
Corpus Christi, Tex
Crosco, Iowa
Crete, Nob
Cumberland, Md -14 (¹) -32 -13 (¹) -36 -10 23 (1) (¹) ·15 85 93 25 57 -21 70. 2 78 20 28 82 10 83 87 

' No record.

# APPENDIX 34.

grees Fahrenheit), from reports made by voluntary observers of the Signal Service, United ing December 31, 1885.

ing thermometers.]

Ja	Ay.	Δu;	gust.	Septe	ember.	Oct	ober.	Nov	ember.	Dece	ember.	Annual
Max.	Min.	Max.	Mán.	Max.	Min.	Max.	Miu.	Max.	Min.	Max.	Min.	range.
•	•		0	D	0	0	0	0	0	0	0	0
10t	G2	96	54	-94	45	80	34	75	28	68	13	98
(2)	(1)	(2)	(2)	(9	€4	(t)	(1)	79	30	73	24	····
98	56 58	92 107	52 . 46	104	32	84 93	36 25	65 80	34	60 75	30 —1	74 134. 5
105 96	53	93	43	84	43	78	30	69	22 19	55	3	97
93	41	87	31	81	27	. 78 80	24	70	ii	55 65	6	ıii
91	58	87	45	83	40	71	31	67	15	55	8	102
96	58	96	52	84	47	80	36	70	28	64	13	108
91	50	(¹) 94	(1)	( ¹ )	(¹) 67	(1)	(1) 41	(¹) 80	(2)	(1)	( ¹ ) 20	<u>-</u>
(t)	71	(1)	70 (')	6	31	88 77	30	80	28	1	20	74
96	( ¹ ) 56	98	Ġύ	95 1	(†) 50	76	32	80 68	25	(1)	17	96
98	0.3	91	54	l 87 l	49	79	28	76 70	21	58 65	(¹) 17 1 20	116
95	55	90	58	88	49	78	84	70	29	65	20	89
88	46	83	43	74	39	74	24	68 72	(1) 28 25 25 21 29 21 28 34	55 65	7	98
96 98	62 52	(¹) 98	(1)	(¹) 94	(¹) 58	78 84	32 43	83	28	79	18	
87	50	88	46	75	44	68	85	60	35	60	29 24	64
75	45	69	41	72	41	71	33	60	32	60	32	l
96	41	86	44	82	40	( ¹ ) 85	(l) 41	· (1)	(1)	(¹) 67	(¹) 20	
99	67	96	59	01	53	85	41	74	33	67	20	88
, (1) 90	(¹) 51	(3)	(f) (f)	93 79	50 37	80 72	82	77 61	( ¹ ) 33 25 22	63 48	20 —7	
- 98	52	90	48	83	40	75	21 24	67	8	54		108
91	48	86	43	78	33	70	20	65	19	58, 9	7	100
. 89	44	96	45	(l) 96	(¹) 27	91	36	58	32 17	64	29 (¹) 4	
93	27	(2)	(¹) 37	96	27	(1)	(2)	60 64	17	(l) 54	(1)	
102	42 50	90 96	37 47	86 91	34 40	84	26 30	64 75		61		
90	50	84	48	80	38	75	24	87	22	56	-4 -0.7	121 108
1100	42	90	42	95	30	86	23	67 72	15	62	17	85
.99	60	94	53	(i) 83	(¹) <b>4</b> 2	83	29	79	18	64	-3	
-96	50	90	41	83	42	80	32	71	12	56	. 5	107
:96 497	53 53	88	41	82 87	39 36	72 04	24 23	60 71	16 14	44 64	10	126
102	58	(¹) 96	(¹) 52	85	52	79	36	70	90	60	5 10	106
300	61	(0)	Ö	1 (1) 1	(l)	101	(1)	6	29 (¹) 20	e e	(1)	
102	46	06	(¹) 45	86	42	79	28	(¹) <b>69</b>	20	(¹) 56	-4	
92	55	88	47	81	38	71	22	66	8	l 50 1	zero.	113
8	(¹) (¹)	8	(') (')	(¹) 86	(¹) 44	(1)	(¹) 32	(¹) 73	(¹) 28 (¹) 22 23 24 38 25 26	(¹) 60	(¹) 4	<b></b>
100	60	100	66	(1)	(1)			65	(1)	(4)	ø,	
.95	68	96	58	(¹) 91	(¹) 53	(¹) 84	(¹) 34	(†) 84 68	22	(1) 84	(¹) 16	92
92	5‡	86	44	81	43	78	33	68	23	62	3	92 107
95	62	87	48	82	45	78	30	66 1	24	55	- 2	
108	50 57	114	48 54	05 184	44 41	101 81	42 29	78 74	38 95	64 49	34 2	80 118
96	52	93	47. 8	86	44	77	29 38	73. 5	26	58	4	109
:95	55	80	53	86	45	77	29	69	20	56	- 7	118
(1) 85	(1)	90	39	83	32	76	26	64	1	52	9	
85	50	82	44	76	37	70	26	68	15	54	4	99
89 94	54 78	88 92	45 79	77 93	37	69	28	54	10	49	zero.	103
93	57	82	45	86	76 37	91 73	54 22	92 55	51 14	(¹) 46	(¹) <b>—2</b> 2	129
-93	51	91	47	92	43	82	23	72	19	66	- 9	118
95	56	88	45	80	44	75	32	66	25	58	8	101 110
100	51	95	48	95	30	78	35	72	25 28	62	9	

¹ No record.

### Monthly maximum and minimum temperature and annual range

Stations.	Jan	nary.	Febr	nary.	Ma	rch.	Ap	ril.	M	ay.	Ju	De.
Stations.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
5/435/4 J	0	0	0					۰		0	0	0
ecricid, Mass	59	-18	46	-14	53	13	85	23	88	25	94	37
es Moines, Iowa e Soto, Nebr	51 49	-26 -26	54 49	-24 -19	65 66	8	74 84	20 25	87 90	26 28	99 10	38 45
istributing, Reservoir,	70	-20	1 30	_12		١ '	•	23	-	40	91	-55
D. C	61	8	53	4	67	13	86	32	87	46	94. 2	
orset, Vtover, N. J	55	-15	89	15	53	-16	82	11	82	24	86	35
over, N. J	58 <b>62</b>	_ 6	49	1 .1	54	_ 8	87	26	85 85	29	90	30
rifton, Pa udley, Mass	(1)	(1)	45 (¹)	16   (¹)	51 (¹)	(1)	85 (¹)	18	(')	31 (¹)	87 83	41 58
berry, Pa	52	-ì2	87	_i5	48	—ìs	83	(¹) 17	84	28	85	×
ston, Pa	58	6	50	sero.	60	10	87	32	87	47	93	53
st Portland, Oreg	56	16	53	28	74	30	76	30	(¹) 79	(0)	87	56 58
Falls, Kans	(')	(2)	88	-10	50	18	72	43		40	70	58
nbarras, Wis omittsburg, Md	36 56	-38 7	46 49	-35 - 1	52 60	-15 7	76 82	16 28	85 80	35 38	89 89	44 52
nporia, Kans	57	-12	61	-14	75	14	78	81	86	36	93	54
la Orag	62	21	68	82	72	34	74	38	79	48	78	49
ctoryville, N Y	49	-16	42	-18	54	-10	86	23	84	32	56	40
irbury, Nebr	(1)	1 3	(¹) 85	(1) 87	68	20	(¹) 88	(2)	87	56	(2)	(¹) 53
li Brook, Cal	73 55	87 2	85   51	87	96 56	41	88	46 25	84 78	57 22	97 85	42
llsington, Pa	57	T 4	40	– i	59	7	84	29	83	42	93	55
llston, Md	54	l i	49	zero.	80	8	82	29	80	45	90	55 33
rsyth. Ga	72	19	78	14	76	33	85	40	86	50	92	64 45
ort Madison, Iowa	45	<b>—23</b>	48	20	65	8	77	25	88	36	90	45
ort Scott, Kans	57	<b>—</b> 12	56 55	-11	78	18	83	32 28	90	41	96	54
ort Wayne, Ind rankfort, Ky	56 58	-15 - 6	63	15 5.8	57 74	10	80 83	26	84	35 36	92	46 51
ranklin, Pa	54	-16	42	-18	40	i2	80	13	80	32	84	38
remont, Nebr	48	-29	50	-24	67	8	81	19	87	27	92	43
allinas Spring, N. Mex .	(ı)	(1)	(t) 44	(1)	66	83	71	44	84	49	92	54
ardiner, Me	51	<b>—15</b>	44	-18	50	-14	70 82	21 8	79	27	82 88	39 36
arrettsville, Ohio	54 44	-19 -23	52	—18 —24	52 67	18 8	76	19	82 83	24 26	90	44
ermantown, Pa	50	2	40		56	1 7	80	26	79	38	90	52
rampian Hills, Pa	44	8	42	-16	48	<b>—10</b>	68	14	84	30	86	44
rand Coteau, La	76	21	73	25	78	36	86	50	88	5G	92	66
reat Falls Reservoir,		١.		اما	۵,	١.,		30	86	43	92	88
Mdreensborough, Ala	64 70	19	50 70	16	61 75	11 28	80 83	40	83	50	94	55 68
reen Springs, Ala	78	16	69	18	74	24	88	85	87	50	94	68
ailford, Ind	(1)	(1)	56	-14	70.8			24	89	32	97	47
uttenberg, Iowa	42	<u>—38</u>	46	30	59	-14	74	24	88	23	88	42
artford, Conn	59	-6	45	-2	56 68	]	86 82	24 80	88 84	30 30	94 96	51 49
arvard, Nebr averford College, Pa	(¹) 60	(¹) 2	60 42	18 —2	50	8 5	80	26	79	36	90	50
elvetia, W. Va	60	_ã	62	_22	65	ــــــــــــــــــــــــــــــــــــــ	84	16	84	33	88	50 43
iram, Ohio	50	12	48	-19	50	<b>—</b> 7	80	20	81	84	87	44
udson, Mich	45	<b>—23</b>	49	36	50	10	82	17	85	23	93	30
umboldt, Iowa	40	-42	88	-31	80	-1	76	22	86	26	94	43
umphrey, N. Y	40 (¹)	-14 (')	46 80	<del>-94</del> 18	45 77	19 34	78 85	14 89	82 85	82 47	84 91	41 64
desville Cal	66	80	72	84	78	42	76	84	õ	(6)	74	50
desville, Cal	35	-26	89	_23	50	-1	70	27	79	34	82	46
dependence, Kans	54	13	61	8	78	21	85	31	84	38	90	55
dependence, Mo	50	<u>14</u>	54	<b>-20</b>	63	12	77	25	86	88	92	48
dianola, Iowa	45 58	-22	45 44	26	62 52	.2	75 86	26 18	84 83	30 29	(1) 88	(¹) 41
cksonborough, Ohio	48	_6 _17	52	—13 —17	62	—14 6	86	22	94	32	94	48
lierson ville. Ind	58	o	63	5	74	13	83	32	86	38	93	52
alamazoo, Mich enewick, Wash	41	10	44	25	48	8	77	21	80	31	73	42
newick, Wash	60	-4	56	20	84	28	84	28	92	40	98	50
conia, Ind	60 50	—10 —33	65 50	6 26	74 64	11 —3	83 79	31 23	83 87	32 34	95 90	55 36
Grange, Ind	42	-18.5	46	-20 -21	49	-8	78	19	80	28	(1)	
Grange, Ind nsing, Mich	45	-16	45	-22	46	-10	80	23	80	29	85	(1)
	56	-12	55	-14.5	73	15	(¹) 87	(1)	(1)	(1)	92	51
Wrence, Lans	78	-5	78	-4	84	18	87	83	- 96	36	102	57
ad Hill, Ark				10	53	5	79	20	83	26	89	41
ad Hill, Ark	55	-, 7.6	48	7.		12	01	0,4 1				
ad Hill, Ark	55 62	11	(1)	(1)	68	15 —7	81 87	24 91	(1)	(1)	87	52
ed Hill, Ark	55 62 55	11 —7	(¹) 47	(¹) —12	68 53	<b>—7</b>	87	24 21 62		(1) 28	87 88	52 41
ead Hill, Ark	55 62 55 68 83	11 7 10 `88	(1) 47 74 85	(¹) —12 15 88	68 53 76 85	-7 32 89	87 84 98	21 62 49	(1) 86 86 86	(1) 28 <b>66</b> 55	87 88 91 95	52 41 81 69
wrence, Kans ead Hill, Ark cleester, Mass motr, N. C t Roy, N. Y berty Hill, La. mona, Fla moninton, N. C gan, Iowa	55 62 55 68	11 -7 10	(1) 47 74	(¹) 12 15	68 53 76	-7 32	87 84	21 62	(1) 86 86	(1) 28 66	87 88 91	52 41 81

¹ No record.

of temperature (in degrees Fahrenheit), &c.—Continued.

Ju	ly.	Aug	gust.	Septe	mber.	Oct	ober.	Nove	ember.	Dece	mber.	Annua
Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min,	range
94 97 97	6 42 48 53	0 (1) 89 92	(¹) 42 44	83 86 92	29 40 43	78 80 83	0 24 23 23	69 67 62	9 17 17	56 55 56	- 5 -10 - 7	0 123 123
98 88 9(1) 88 30 101 96 99 99 99 102 103 101 101 101 101 101 101 101 101 101	60 42 44 (1) 42 64 56 50 57 62 (1) 55 55 52 67 62 (2) 62 (3) 63 63 64 64 64 64 64 64 64 64 64 64 64 64 64	93 88 88 90 85 86 92 (1) 82 (2) 90 94 97 115 87 90 95 95 95 95 95 95 88 89 99 99 99 99 99 99 99 99 99 99 99	51 33 40 35 55 42 55 42 70 60 45 50 42 49 47 60 43 38 47 60 43 49 49 49 49 49 49 49 49 49 49 49 49 49	89 78 88 82 77 86 86 86 80 80 90 110 82 84 85 (1) 87 85 76 84 87 88 89	50 33 38 38 31 35 52 44 45 47 49 40 44 48 (1) 40 44 45 40 44 45 40 44 46 46 46 46 46 46 46 46 46 46 46 46	76 77 77 77 72 83 78 76 75 89 105 76 76 77 78 88 81 (1) 105 77 77 77 77 77 77 77 77 77 77 77 77 77	35 10 20 37 32 20 30 32 26 36 28 39 38 42 32 42 32 42 32 42 32 42 42 42 42 42 42 42 42 42 42 42 42 42	70 71 68 72 65 67 70 68 55 56 57 70 (1) 85 64 67 70 66 72 71 64 67 67 68 67 68 67 70 66 72 71 66 72 72 73 74 75 76 76 76 76 77 70 70 70 70 70 70 70 70 70 70 70 70	29 9 18 12 20 29 21 25 20 27 23 40 40 27 28 28 22 22 23 22 28 26 10 18 34 34 40 40 40 40 40 40 40 40 40 40 40 40 40	63 61 57 56 57 48 (1) 54 47 46 61 60 53 53 54 86 58 65 72 60 65 65 65 65 67 60 61 61 63 65 65 65 65 77 60 60 60 60 60 60 60 60 60 60 60 60 60	17 zero. 6 6 7 4 -11 -10 (1) 22 5 -22 10 zero. 7 -4 11 11 -12 4 -4 -11 -9 5 -13 -14 -8 28	94 104 95  111  127  111 77 112  81 90 98 97 81 11 123  103 5 106 108 111 124  118 109 109 118 118 119 119 119 119 119 119 119 11
(95 99 99 99 99 99 99 99 99 99 99 99 99 9	54 66 67 477 539 34) 38 547 524 56 61 59 61 52 543 (1) 456 6(1) 524 79 60 525 543 (1) 7 66 6(1) 524 66 61 52 543 (1) 524 66 61 52 546 61 52 546 61 52 546 61 52 546 61 52 546 61 52 546 61 52 546 61 52 546 61 52 546 61 52 546 61 52 546 61 52 546 61 52 546 61 52 546 61 52 546 61 52 546 61 52 546 61 52 546 61 52 546 61 52 546 61 52 546 61 52 546 61 52 546 61 52 546 61 52 546 61 52 546 61 52 546 61 52 546 61 52 546 61 52 546 61 52 546 61 52 546 61 52 546 61 52 546 61 52 546 61 52 546 61 52 546 61 52 546 61 52 546 61 52 546 61 52 546 61 52 546 61 52 546 61 52 546 61 52 546 61 52 546 61 52 546 61 52 546 61 52 546 61 52 546 61 52 546 61 52 546 61 52 546 61 52 546 61 52 546 61 52 546 61 52 546 61 52 546 61 52 546 61 52 546 61 52 546 61 52 546 61 52 546 61 52 546 61 52 546 61 52 546 61 52 546 61 52 546 61 52 546 61 52 546 61 52 546 61 52 546 61 52 546 61 52 546 61 52 546 61 52 546 61 52 546 61 52 546 61 52 546 61 52 546 61 52 546 61 52 546 61 52 546 61 52 546 61 52 546 61 52 546 61 52 546 61 52 546 61 52 546 61 52 546 61 52 546 61 52 546 61 52 546 61 52 546 61 52 546 61 52 546 61 52 546 61 52 546 61 52 546 61 52 546 61 52 546 61 52 546 61 52 546 61 52 546 61 52 546 61 52 546 61 52 546 61 52 546 61 52 546 61 52 546 61 52 546 61 52 546 61 52 546 61 52 546 61 52 546 61 52 546 61 52 546 61 52 546 61 52 546 61 52 546 61 52 546 61 52 546 61 52 546 61 52 546 61 52 546 61 52 546 61 52 546 61 52 546 61 52 546 61 52 546 61 52 546 61 52 546 61 52 546 61 52 546 61 52 546 61 52 546 61 52 546 61 52 546 61 52 546 61 52 546 61 52 546 61 52 546 61 52 546 61 52 546 61 52 546 61 52 546 61 52 546 61 52 546 61 52 546 61 52 546 61 52 546 61 52 546 61 52 546 61 52 546 61 52 546 61 52 546 61 52 546 61 52 546 61 52 546 61 52 546 61 52 546 61 52 546 61 52 546 61 52 546 61 52 546 61 52 546 61 52 546 61 52 546 61 52 546 61 52 546 61 52 546 61 52 546 61 52 546 61 52 546 61 52 546 61 52 546 61 52 546 61 52 546 61 52 546 61 52 546 61 52 546 61 52 546 61 52 546 61 52 546 61 52 546 61 52 546 61 52 546 61 52 546 61 52 546 61 52 546 61 52 546 61 52 546 61	94 (1) 96 90 88 88 (1) 92 90 85 95 (2) 95 89 87 101 96 83 112 96 83 (1) 104 88 88 99 89 89 89 89 89 89 89 89 89 89	50 (1) 65 49 441 (1) 39 487 427 47 63 (1) 55 52 49 40 40 52 43 41 (1) 53 53 76 76 76 76 76 76	87 97 92 84 100 (1) 85 84 80 80 82 (1) 85 85 81 80 92 81 82 82 82 82 82 82 82 82 82 82 82 82 82	42 56 (1) 30 38 48 41) 32 38 38 41) 32 44 44 41 42 43 41 41 42 43 41 42 43 43 44 44 45 46 47 48 48 48 48 48 48 48 48 48 48	75 81) 74 80 92 (1) 72 75 76 84 (1) 83 77 77 90 88 77 77 90 88 77 91 92 92 92 92 92 92 92 93 94 94 95 96 96 96 97 97 97 97 97 97 97 97 97 97 97 97 97	32 42 30 24 24 27 24 29 31 22 32 34 31 22 32 34 30 (1) 30 21 30 30 31 32 32 32 34 30 30 30 30 30 30 30 30 30 30 30 30 30	70 66 (1) 66 (1) 70 67 62 61 70 68 77 70 68 77 70 68 77 70 68 77 70 68 77 70 68 77 70 68 77 70 68 77 70 68 77 70 68 77 70 68 77 70 68 77 70 68 77 70 68 77 70 68 77 70 68 77 70 68 77 70 68 77 70 68 77 70 68 77 70 68 77 70 68 77 70 68 77 70 68 77 70 68 77 70 68 77 70 68 77 70 68 77 70 68 77 70 68 77 70 68 77 70 68 77 70 68 77 70 68 77 70 68 77 70 68 77 70 68 77 70 68 77 70 68 77 70 68 77 70 68 77 70 68 77 70 68 77 70 68 77 70 68 77 70 68 77 70 68 77 70 68 77 70 68 77 70 68 77 70 68 77 70 68 77 70 68 77 70 68 77 70 68 77 70 68 77 70 68 77 70 68 77 70 68 77 70 68 77 70 68 77 70 68 77 70 68 77 70 68 77 70 68 77 70 68 77 70 70 70 70 70 70 70 70 70 70 70 70	25 31(-)22(-)13 22(-)26 214 16 228(-)29 228 228 241 (-)29 247 280 247 280 25 268 241 241 25 25 25 25 25 25 25 25 25 25 25 25 25	60 69 (1) 54 48 68 (1) 70 54 67 71 54 61 (1) 54 65 61 61 61 61 61 61 61 61 61 61	12 27 (1) 0.2 -12 6 (2) 25 (2) -10 -1 (1) (1) 25 6 6 -3 100 -7 (-2 sero. 4 13 -1 (13 44 288 17 0.5 -5 (14 17 0.5 (15 17 0.5 (15 17 0.5 (15 17 0.5 (15 17 0.5 (15 17 0.5 (15 17 0.5 (15 17 0.5 (15 17 0.5 (15 17 0.5 (15 17 0.5 (15 17 0.5 (15 17 0.5 (15 17 0.5 (15 17 0.5 (15 17 0.5 (15 17 0.5 (15 17 0.5 (15 17 0.5 (15 17 0.5 (15 17 0.5 (15 17 0.5 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Monthly maximum and minimum temperature and annual range

	Jan	nary.	Febr	nary.	Ma	rch.	Ap	ril.	M	ay.	Ja	B6.
Stations.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min
Luling, La	76	o 23	o 78	o 26	o 81	° 32	o 83	o 49	° 90	53	93	o G4
Lunenburg, vt	50	_19	34	-26	48	-24	80	8	82	28	83	43
Andison, Nebr	44	-21	48	-22	60	7	73	21	81	30	85	48
fadison, Wis Iahonoy Plane, Pa	(1)	—25 (¹)	40	$-22 \\ -12$	54	-5 2	74 84	21 26	81 87	27 40	(¹) 92	(¹) 53
Manatee, Fla	86	42	42 86	37	55 92	48	88	59	87	69	94	63
fanchester Town	39	26	43	-25	60	-10	72	22	90	25	88	43
fanhattan, (B) Kans	56 45	20 36	56 42	-18 -28	63 50	12 -29	74 65	26 6	90 78	32 24	98 80	51 32
fanhattan, (B) Kans fanistique, Mich fanitowoo, Wis	38	-24	43	-24 -24	48	-11	61	18	82	18	82	36
fariotta, Cal	(4)	(4)	(1)	(1)	(¹) 65	(¹) 13	( ¹ )	(¹) 29	(1) 81	(¹) 35	(0)	(1)
darion, Va	65 42	_24 24	56 48	- 8 - 6	66	13	83 77	44	81	45	86 94	53 50
Marquette, Nebr Mattoon Ill	45	-20	53	-14	70	8	70	29	89	35	90	47
Maud, Kans	58	-18	64	<b>—</b> 9	78	21	84	36	89	33	101	54
fanzy, Ind faynard, <u>I</u> owa	48 36	20 36	43 36	-20 -29	(¹) 50	(¹) -16	78 67	20 18	82 80	30	87 84	40 38
fayport, Fla	81	41	76	38	85	40	88	58	88	64	95	74
Mazatian. Mox	79	51	79	54 — 3	82	55 7	84	57	88 82	60 57	92	66 53
cDonogh, Md Ienand Station, N. Y	50 52	-11	46 40	-10	89 45	_ 6	91 83	28 26	81	38	86 85	47
<u> Meudon, Mass</u>	57	<b>— 4</b>	42	- 4	54	4	76	30	76	37	87	46
Merritt's Island, Fla Milan, Tenn	(¹) 65	(')	(1) 72	(¹) 5	(¹) 76	(1)	(¹) 82	(1) 35	(¹) 89	(1)	92 95	71 59
Milledgeville. Ga	71	- 1.5 21	71	13	75	24	80	32	90	44	04	60
Milton, Mass	54	<b>- 6</b>	46	3	55	5	79	30	80	30	91	47
Minneapolis, Minn Monticello, Iowa	42	-38 -28	44	30 26	49 62	- 7 - 7	70 74	19 21	86 85	28 25	87 90	41 39
doorestown, Mich	42	32	47	-32	45	33	78	2	85	18	(6)	(1)
100restown, N. J	90	4	42	<b>— 2</b>	63	6.5	85	27	(t)	(1)	96	55
Mottville, Mich Mountainville, N. Y	60	-24 zero	50 46	-83 - 7	50 53.7	-10 - 4	80 86	22	86	38	86 91	40 41
Lount Forest, Canada	44	-17	36	<b>_2</b> 1	37	_18	76	24 7	66	30	82	39
Mount Ida, Ark	(l) 41	(¹) 27	72	6	78	22	86	32	84	36	91	56
Mount Vernon, Iowa Muscatine, Iowa	48	-27 -34	46	28 30	62	- 4 3	79 77	22 21	90 85	34 29	93 91	53 41
Nayatt's Point, R. I	54	zero	38	3	68	2	82	31	82	40	90	58
Neillaville, Wis		-42	36	-37	41	20	65	8	87	16	88	27 35
Nephi, Utah New Bedford, Mass	52 53	zero 1	55 44	16 0. 5	70 54	17	67 74	30 27	83 80	30 32	88 85	46
Newport, Vt New Ulm, Tex	50	21	40	40	48	30	86	14	84	28	88	42
New Ulm, Tex North Colebrook, Conn	(1) 55	(¹) —18	(1)	(3)	80 52	6	78 80	60 18	79 82	59 22	85 83	78 45
Northfield, Minn	37	40.9	46	-11 -31	50	<b>—12</b>	75	16	84	25	86	35
North Lawishurg Ohio	49	-16	53	-17	60	- 2	80	20	85	83	92	44
Northport, Mich North Volney, N. Y	84 49	-18 -11	40 39	-22 - 7	54 50	-18 - 9	74 87	20 19	80 84	20 29	(l) 87	(¹) 45
Oakland, Cal	60	-87	70	4i	76	43	78	42	86	49	71	52
Orono, Me	53	22	41	-17	49	-21	76	20 43	70	28	86 90	39 57
Oroville, Cal Oskaloosa, Iowa	(1)	_31	46	(¹) _20	86 60	46	84 73	26	96 85	52 33	84	47
ttumwa, Iowa	43	(¹) 21 22	48	-23	63	10	80	29	86	33	91	50
Ottumwa, Iowa Pacolet, S. C Palermo, N. Y	62 46	16 —13	60.7 86		61 48	20 —19	76 84	41 16	75 80	63   39	84 84	65 42
Paramaribo (Dutch Gui-	30	_13	50	<b>—11</b>	10		O*		~	1	1	
ana), S. A	88	66	88	66	89	68	91	67	80	70	88	70
Paterson, N. J Peoria, Ill	60 48	-22	41 49	- 4 -22	(1) 64	(¹) 10	85 79	29 30	(¹) 89	(¹) 37	88 95	54 48
Phillipsburg, N. J Pierce City, Mo	60	2	40	- 1	66	2	(1)	(¹) 82	84	33	90	46
Pierce City, Mo	63	-11	63	8	70	17	84	82	87	34	93	55 40
Point Pleasant, La	48	- 6 19	53 69	10 20	75 78	18 30	77 88	18 46	87 86	32 55	86 93	67
Portsmouth, Ohio	1 68 K	4	68	- 6	74	7	92	26	91	40	92	49
Post Mill Village, Vt		4(4)	43	-26	55 827	-20 27	86 88	16 46	84 80	20 52	89	87 55
Poway, Cal Prairie du Chien, Wis	45		87L	-23	-87 52	-5.9	60	-23 1	84	80	93	45
Princeton, Cal	66	84	72	83	85	40	84	81	101	44	93	44
Princeton, Mass Princeton, N. J	46.8			-P1	49 58	1-4	79 85	21 26	79 84	21 37	84 93	41 49
Providence, B. C	60	2	((1) 52.2	(1)	59	2	83	23	85	28	88	44
Pueblo, Colo	·68	16	04	-3	73	20	79	32	90	87	92	54
Puerto de Luna, N. Mex. Quakertown, Pa	M9 57	=12 sero	·60 45	10	74 53	25 2	78 82	41 24	86 80	41 31	98 89	61 43
Raleigh, N. C	-69	16	l (¹)	·(i)	00	(1)	:90	36	89	50	94	65
Kesaington, N. J	64	G	48	<u>–2</u>	(1)	(4)	02	34	790	44	98	60
Receiving Reservoir, D.	164	1 4	56	<b>]</b> 3	165	1.10	۱ 86 ا	81	l 487 /	46	93	58
(C												

of temperature (in degrees Fahrenheit), &c.—Continued.

Jt	ıly.	Aug	ust.	Septer	mber.	Octo	ber.	Nove	mber.	Dece	mber.	Annu
Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	range
•	•	•	0	•	0	0	0	0	0	0	0	0
94	60	93	61	90	60	80	37	79	31	76	20	1
85 95	48 59	83 85. 2	36 50. 1	75	35	74	21 //	60 60	10 18	61	2010.	l
90	52	82	46	(l) 79	35 (') 42	(¹) 71	21 (¹) 26 35 55 27 (¹) 22	(¹) 67	( ¹ ) 13	51	13	
90 97	52 58	89	53 77	84 92	45	74 88 78	35		13	52	8	
92	76	93	77 43	92	74	88	55	89 60	40 20 22 22 19	86 50	28 —8	1
90 102	54 60	87 08	41	96	42 52	1 68	(4)	74	20 22	58	===	1 3
92	41	85	37	80	29 34	(¹) 68	22	58	22	46	8	1 :
92	46	84	41	86	34	67	24 35 ·	54	19	46	-15	
105 89	59 46	111 88	58 51	107	45 36	100 69	35 .	80 69	27 25 31	80 68	27 16	9
93	56	80	59	84 87	50 52	76	28 37	62	30 31	54	18	11
102	58	93	51	1 90 I	37	81	29	69	23 (¹) 15	61	2	12
102	63	104	54	(i) 81	(1)	(¹) 72	(1)	(¹) 67	(1)	(9)	(4)	
94	42	92	41	81	33	72	24	67	15	1 (2)	(2)	
98 92	51 73	88 93	40 75	(¹) 90	(')	(')	(')		83	1 22	1 8	
92	61	03	40 75 65	02	(1) 33 (1) 72 68	(1) 86 88 72 72 70 87	29 (1) 24 (1) 58 67 33 28 29 56	(¹) (¹) 85	(¹) (¹) 63 27 17	(1) (1) (1) (1) 86 60 56 56 76 65 73	(1) (1) (1)	4
OCI I	54 57	87	45	80	43	72	83	69 I	27	60	18	1 9
92 88 90	57	86	45 52 . 51 73	80	42	72	28	67	17	56	8	10
88	58	82 94	. 5l	86 89	41	70	29	66 82	18	76	10	9
97	58	98	54	92	73 41	81	81	80	23	65	88 17	9
96	74 58 <b>63</b>	94	66	92	56	78	28	(4)	41 23 (¹)	73	21	1
90	55	85	51	78	35	(3) 78	(¹) 24	(¹) 67	18	] 61	10	13
04 00	61 51	86 88	45 41	84 83	40 40	78	24 24	52 61	15 17	48 46	-15 -11	12
(7)	6)	1 28	(1)	1 65	(1)	1 6	(1)	1 %	65	(1)	_;;	1
99	(¹) 60	8	8	1 65	(1)	(¹) 81	(¹) 81	(¹) 72	(¹) 25	60	(¹) 7	
90	46	90	41	800	36	72	26	62	18	46	4	12
99 86	44	90 79	4.3 43	84 70	37 40	76 68	29 16	70	7 21	59 43	- 7	10
95	48 57	93	93 56	90	40	86	28	59 80	21	70	15	10
es l	(1)	(¹) 92	(¹) 45	(4)	Ö	78	27 26	63	20	48	-10	
102	49	92	45	(1) 92	44	80	26	l 65 I	18	47	-7	13
$\mathfrak{Q}$	(¹) 36	(¹) 81	(¹) 20	(¹) 79	(1)	(1) 68	(¹) 7	(!) 42	(¹) <b>— 2</b>	(¹) 86	(¹) 33	
83	51	96	47	1 (%)	22 (1)	(1)	n/s	(1)	- Z	1 (1)	-03	18
90	52	86	45	82	(¹) 37	(¹) 70	(1)	68	(¹) <b>23</b>	(1)	(1)	8
93	50	86	42	· 78	36	1 76	· 22	56	5	1 48	10	18
(¹) 93 90 93 95 88 92	74 50	86 87	78 49	96	60	88	43	89 70	62 6	82	26 - 2	10
92	50	81	38	85	24 34	88 70 77 70	23	54. 9	14. (	50 51 55	_16	13
99	51	81 94	38 47	86	38	79	21	l 67 I	21	55	-16 - 2	lii
(¹) 90	74 56 50 51 (¹) 52	88 80	46	(1) 82 76 96 82 85 85 (1) 80	(¹) 40	(¹) 75	32 23 21 (¹) 22	(¹) 67	(¹) 15	(1) 53	(1)	l:
84	57	85	46 53	80	40 51	75	45	72	15 43	88	41	10
86	54	84	44	89 78	34	70	23	59	14	66 56 75	2	1 10
86 96	60	102	63	I 97 I	56	70 94 75	23 52	74	42	75	87	
92	5 <b>6</b> 59	(¹) 91	(¹) 54	(¹) 87	51 34 56 (1) 44	75	36	67	14	1 51	-16	
00 85 91	67. 1	85	65	79	60	(¹) 68 76	(l) 41	(¹) 68	(¹) <b>29</b>	65	(¹) 223	7
91	50	- 66	65 43	75	36	76	21	73	15	(¹) 65 47	5	11
90	70	91	71	92	72	94	72	94	73	92	69	2
4)	·( ¹ ) 53	90	751	(1)	( ¹ ,) 48	(¹) 75	(¹) <b>80</b>	(¹) 68		54 52	17	
04	53 50	97	52 45	87	48	75	80	68	26	52	- 3	12
Me	50 50	98	51	85	50	60 82	20 29	(2)	(2	50	-20 8	10
95	40	96	41	(1) 87 (1) 85 86	(\) 50 32	83	19	(1) 78 58	20	55	- 6	100
(1) 04 97 06 95 96	67	'96	41 68	'90 83	59	83 82	40	84 73	(1) 26 (1) 19 20 25 26	65 75 78 66	21	7
98	47 56	-90 -80	52 85	83 82	40 31	78 75	28 21	73	26	68	18	10
1	-60	103	64	103	57	97	41	59 82	6 38	85 85	14 85	1
8	65	84	51	I -83 I	41	777	25	60	16	47	-5	12
1	54	100	54 39	100 78 83	52	(¹) 70 80	25 (-) 27 33	(1)	(¹) 18	60	88	
8	46 54	94 90	40	83	32 40	80	27	62 70	18	56 59	14	10
	(6)	( ¹ ) 95	(¹) 55	(6)	(1)	(6)	(1)	(6)	26 (¹)	(1)	10	
6 6 8 2	(¹) 62	95	55	(1)	(¹) (¹) 48	(¹) 81	80	(¹) 76	(¹) 20	(¹) 76	(¹) —2	[
9	68	99 88	63	86	48	I 823 J	31	61	22	70	10	11
a i	48 63	97	44 62	(1) (1) 86 (1) 78 92	38 (¹)	72 79	26 29	64 72	20 26	48	8	
2	62	94	52	92	50	78	36	72	28	(¹) 62	(1) 14	:::::
6	.50	93	55	86	48	75	37	-69	29	62	44	

1 No record.

Monthly maximum and minimum temperature and annual range

	Janu	ary.	Febr	nary.	Mai	rch.	Ap	ril.	M	ay.	Ju	De.
Stations.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Mis
	•	•	0	•	•	•	۰	0	•	0	•	•
Richardton, Dak Richmond, Ky	87 57. 1	36 5	40 62	-23 -6	48 71	-6 10	70 83	26	80 83	20 38	83 89	40 50
Riley, Ill. Rock Creek Bridge, D. C	40	26. 4	40	-24	56	-4	74	29 23 84	85	29	86	42
Rock Creek Bridge, D. C Rockford, 111	65	28	52 42	<b>-25</b>	72 54	14 -2	88	84	90 79	51 81	100 85	63
Round Grove, Iowa	46	34	44	26	57	zero	77	25 25 16	82	20	(¹) 82	45 (¹) 48
Rowe, Mass	48	-12 -14	39 46	—12 —15	51 53	-16 7	79 72	16 22	84	30. 4 35	82 90	48 45
Ruggles, Ohio Sacramento, Cal	63	31	72	82	80	37	87	85	100	45	92	49
Salom, N. J Salina, Kans	60	10 21	48 45	_5 _6	65 74	13 16	88 85	82 28	90	44	'95 88	48 00 56
Salinas City, Cal Sandwich, Ill	70	80	75	32	82	36	82	41	76	50	73	51
Sandwich, Ill	46 63	31 80	46 73	-34 80	61   80	-3 32	78 83	26 32.8	84 90	83 87	84	36
San Rafael, Cal Shirlock, Kans	53.3			0.5		17	80	85	86	83	94	56
Snowville, Va Somerset, Mass	67	8	52	-2	64	13	82	29	82 89	33	85	50
Somerset, mass Somerville, N.J	48	2.6	52 44	-6 -3	58 58	2010	85 87	28 31	86	32 39	96 91	56 56
South Bethlehem, Pa	59	-6	45	6	57	2	90	24	80	30	96	1 2
South Evanston, Ill Southington, Conn	( ¹ ) 59	(¹) —8	44	-24 3	55 58	-2 sero	78 87	21 25	82 86	29 28	89. 8 93	35 50
South ()range, N. J	62	zero	44	2	62	8	86	26	88	40	92	56
Spiceland, Ind Springfield, Mo	49 63	19 9	52 64	-14 -13	64 76	-l	78 81	25 30	85 83	32 40	(¹)	41
Stateburg, S. C	1 72	20	64	16	67	26	85	84	88	48	93	50
Statesville, N. C	67 55	14 -22	62 62	-12	60 82	20 14	87 83	29 28	86   84	83	92	53
Sterling, Kans Stockham, Nebr	50	zero	58	zero	70	38	76	44	84	40	92	64
Strafford, Vt Summit, Va	48	-18	40	-16	44	-18	80	14	82	26	86	48
Summit, Va Sunman Ind	#8 49	6 18	62 58	_3 _14	72 68	sero	88 80	25	88   90	33	97	45
Sunman, Ind Sussex, Wis Swanwick, Ill	87	-25	89	-24	51	8	76	19	84	27	85	41
Swanwick, Ill Swartz Creek, Mich	60 45	-14 -27	67	-10 -27	77 45	12 —13	78 80	80 19	86   81	36 24	89 87	50
Sycamore, Ill	41	26	42	-27	54	_i	75	25	93	31	87	44
Tacoma, Wash	62	26	55	81	68	32	75	35	70	43 63	76	47
Tallahassee, Fla Taunton, Mass		26 -3	(¹) 52	P	79 57	34 4	83 84	45 27	88 88	82	(¹) 91	(') 41
Tesumseh, Nebr	50	-24	60	24	66	13	76	25	83	29	99	50
Terre Haute, Ind Thornville, Mich	49	$-17 \\ -12$	51 85	—10 —22	63 49	10 —11	78 81.4	31 12	83 85	43 28	87 86	43
Tiffin, Ohio	45	-16	47	18. 5	. 58	- 4	81	23	85	33	90	41
Topeka, Kans Traverse City, Mich	65 35	-14 -25	55 44	18 25	77	14 24	78 78	32 11	88 83	39 20	96 93	5.5 32
Troy, Pa. Variety Mills, Va	54	16	42	18	57	8	85	20	88	25	90	37
Variety Mills, Va Vermillion, Dak	62 46	5 33	60. 7 69	2 24	71 64	zero	86 76	23 17	84 85	83 25	(l) 90	('
Vevay, Ind	52	<b>—10</b>	59	<b>- 9</b>	75	8	85	80	87	36	93	51
Vineland, N. J	67	5	54 44	_ 1 _ 2	61	7.	84 76	27 26	85 84	41 36	97 88	51 51
Voluntown, Conn Wabash, Ind	48	21. 2		-15	(¹) 60	(¹) 2	75	27	82	87	88	42
Washington City	(1)	(1)	(1)	(1)	(4)	Q.	( ¹ ) 84	(1)	92. 5		95	6
Washington, Pa Waterville, Me	48 43	16	50 47	— 8 —30	59 56	6 16	84 84	25 20	87 86	43 25	( ¹ )	42
Wausau, Wis	36	36	44	-29	47	-17	76	12	84	23	87	32
Wauseon, Ohio	47. 6 55	—29. 4 —33	51 <b>62</b>	-24 -38	56 70	- 7 -24	82 79	12 20	83 91	21 8	90 94	38 29
Weldon, N. C	72	15	62	10	70	10	87	84	86	48	90	61
Wellington, Kans	51 52	$-10 \\ -12$	54 44	- 6 -22	80 52	18  —12	85 81	29 18	85 85	32 30	95 85	53 36
Wellsborough, Pa Westborough, Mass	60	<b>—</b> 18	53	<b> 2</b>	60	sero	85	25	89	25	96	40
West Chester, Pa	62	1	52	8	82	4	85	26	84	84	92	48
Westerville, Ohio West Leavenworth, Kans	54 64	-13 -10	52 64	-18 -16	60 72	- 0.5 16	82 77	22   28	83 · 88	32 38	88 94	42 50
Westmoreland, Kans	(1)	l (')	l (')	( ¹ )	(1)	(1)	79	26	82	26	100	44
West Union, Iowa White Plains, N. Y	35 60	-32 - 2	40 42	-28 - 1	51 53	-11 1	71 78	21 24	82 80	26 32	85	40   55
Wilkesbarre, Pa	56	- 8	45	12	57	<b>— 3</b>	89	21.2	89	81	91	46
Williametown, Mass Wilton Centre, Ill	56 48	10 32	88 46	—10 —32	48 63	-14 - 4	81 80	20 19	80	27	83 93	40
Woodstock, Md	60	- 1	48	<b>— 3</b>	67	6	84	27	81	23	93	44
Woodstock, Md Woodstock, Vt Worcester, Mass	52	-29	41.4	-38	52	-27	86	15	86	21	93	3
worcester, Mass Wyandotte, Kana	54 52	<b>- 4</b>	39 52	- 3 -14	51 72	16	78 74	25 30	77   87	36 38	84 91	50
Wyandotte, Kans Wysox, Pa Wytheville, Va	Ö	l Ø	(1)	(1)	(1)	(¹)	84	24	80	83	86	46 47 47 47 47
Wytheville, Va Vetes Centre Fana	65 51	3	65	- 4.5 -10	65 77	10	79 78	27 81	81 87	38 34	87 90	43   65
Yates Centre, Kans Yellow Springs, Ohio	(1)	(¹) 26	(¹) 52	(1)	63	_'i	80	28	92	83	89	4
				—ì8		<b>—1</b> 1	79	81	86	38	92	51

'No record.

of temperature (in degrees Fahrenheit), fc.—Continued.

(ax.	Min.	1					. —					Annu
		Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	range
	•	0	0 1	0	0	0		•	0 1	•	•	<del>  •</del>
95	46	94	42	97	84	79	22	56	10	59	-10	133
(¹) 92	(1) 48 61 55 50 48 52 40	94	48 45, 7	975 880 979 ()780 93()785 937 ()90 ()875 887 987 987 988 988 988 988 988 988 988	30 86	75	29 24	71	26 23 31 19 (¹) 13	60 42	—12	118.
101	61	97	56	92	51	78	39	60 74	31	64	16	97
91 !	55	84 97 84 86 84 88 102	48	79	41	<b>69</b> 78 70	25	59	19	43	10	97 119
91 86	50	86	50	(2)	(1) 44 (1) 58 44 8 44 (1) 43 9 42 44 8 8 44 47 7 7 2 44 0 58 5 58 (1) (1) 6 5 5 6 6 3 44 42 (1) 13 16 16 17 17 18 18 18 18 18 18 18 18 18 18 18 18 18	() 70 90 71 72 74 94 83	(') 20	59 (1) 62 65 74 (1) 53 72 66 78 79 68 68 71 65	()	(i) (i) 51	(1)	
94	48 52	RR R	46 48	80	40	70	(1)	62	13	(') 51	(')	109
97	49	102	50	93	43	96	(¹) 37	74	36	67	34	71
0,	65	94 84	50 56	(1)	(1)	(1)	(1)	(1)	(¹) 81. 2	(¹) 53	(¹) 14	
88 76 07	62 51	78	67 52	78	58 46	71	39 38. 3	72	81.2	74	32	111
07	62	76 87	i 50 l	83	48	74	29	66	30 20	74 46	-14	65 11
94	41	(!)	(1)	97	41	94	34	78	14	73	81	
1)	62	(1) (1) 88 94 91 91	(†) (†) 40	(2)	(1)	82	34 29 28	78	19	71	3	·····
14	(¹) 44	94	14	88	39	70 76 75	82	68	20	62 67	22 7	109
36	61	91	44 54	85	42	75	83	68	24	54	10	109 98
3	46	94 •	46	89	40	l 82 1	33 30 29 27 34 29 25	71	14 19 22 20 24 16 20	(¹) 46	—(¹) —18	
15	42 53	8	(i) (i) 54	80	38	70	29	70	20 11	46 57	—18	
16	56	86	54	85	44	76	34	76	30	60	14	98
16	56 47	(1) (1) 88 94 92	46	83	87	73	29	68	19	54	<b>—3</b>	98 115
14	. 59 . 59	92	58	83	47 59	80	25	79	22	62 66	sero 24	
3	. 60	93 93	58 64 55	90	44	73	83	71	31	62	24	77 85
9	60	97	I FAL	89	50	85	29	76	22	65	-6	121
8	70 52	96 86	64 42 46	92	58	84	42	72	38	68	20	100
ő	50	99	16	95	85	79	30	73	24	50 62 51	goro 9 —2	106 102
6	50 50 51	04	1 48	84	86	76	26	67	20	51	-2	114
o	51	(¹) 96	(1) 58	(2)	(2)	(2)	(2)	g l	g	(1)	(1)	
2	(¹) 44 53 51 74 50 58 54 55 53	(1)	(1)	82	36	70 78 78 77 73 85 87 76 (1) 74 72 82 76 82 76 88 75 88 87 88 87 88 87 88 87 88 87 88 87 88 87 88 87 88 87 88 87 88 87 88 87 88 88	40 83 29 42 24 80 (1) (1) 13 25 89 46 29 25 84	70 76 68 79 76 71 76 72 56 67 67 60 77 71 72 67 68 69 78 55 69 71 71 71 71 72 67 71 71 71 71 71	221 31 222 38 8 24 2(1) 221 34 319 16 228 23 23 23	(†) (†) 50	(+) (+) (+)	l
4	53	(¹) 86 84 92	(1) 47 52 78 48 52 52	86	85	72	25	62	21	42	10 28 26	121
6	51	84	52	75	46	64	39	60	84	42 60 72 61 56 58 49 54 71	28	69
2	50	90	48	87	84	75	40 20	77	10	72	20	97
2	58	96	52	92	44	82	25	72	16	56	-3 -2 -2 -2	97 126
4	54	90	52	80	42	72	84	67	28	58	2	1111
5	53	80	50	80	41	76	24	68	28	49	- 2	116 113
ŏ	61	99	57	94	51	88	26	78	19	71	<b>— 3</b>	118
2	44 40	87	44 50 57 48 86	85	86	75	24 80 26 18	55	23	43	1 2	118
6	40	(1)	86	83	83	80	27 28 23 32	65	5 19	49	-,1	114
	(') 46	95	39	) Si	32	84	23	72	13	58	11.4 14	132
n I	50	90 96 90 86 94 99 87 94 (1) 95 96 92 90 (1) (1) (1) (1) (1) 80	(1) 39 51 58 50 (1) (1) (1) 36 40 44 58	85	43	78	82	71	13 25 (¹) 14 (¹) 28 16	60 58 62	1 7	132 110
2	50 58 62 58 57	92	58	98	54	(1)	(¹) 30	(1)	(1)	(1) 60	(1)	
	58	Õ	1 %	1 6	(1)	65	(1)	1 %	1 75	(1)	di di	ļ
8	57	(1)	(9)	90	44	77	87	(i) 70	28	(4)	(6)	
)	- 22	9	1 2	(2)	(1)	75	28	68 61	16 15	(2)	(1)	ļ
3	(¹) (¹) 42	80	36	85	28	73	(1) 87 28 25 13 14	46	18	48	(1) (1) (2) -22 -7 -13	120
3	46	91 99	40	87	81 .	78	14	46 69	16	54	-7	127
) I	46 62	99 98	144 59	98 93	27	83	21	1 52	16 29	56	-12	1 137
}	64	101	49	98	49	81	25	78	20	80	22	112
3	54	90 90	j 40	84	88	78	28	70	22	48	- 9 - 2 9	1 111
3	45	90	40	85	34	78	21 37 25 28 28 33	72	12	64	9	10 10
3	44	89 90	47	84 80	(1) 86 28 81 27 44 49 88 84 42	74	23	68	20	59	9	101
3	61	97	52	85	49	(1) 77 75 84 78 78 83 78 81 78 78 78 75 74	81	80 78 70 72 68 68 76	25	(1) (1) (1) 56 48 54 56 68 69 48 64 58 57	1 6	111
	64 54 45 53 44 61 (¹) 52	101	47	96	45	87	23 81 24 20	70	22 12 26 21 25 20 17	58	-4 -10	1
	52	86 84	45 54	82 78	39 38	73 72	20	56	17	46	-10	12
;	59 42	93	41	86	38	83	33 80	72	20 12	55 56	7 5	100
7	42 43	89	34	76	87	72	26	67	10	59	5	103
	39	96 91	42 45	90 84	35 37	(¹) 72	(1)	(1)	(1)	(1)	(1)	1
3 3	50 44 -	87.	B 34	82	32	75	30 22	78 62	<b>—10</b>	(¹)	6	10
;	53	82	45	77	38	70	30	65	12	58	(1)	9
)	60	94 88	53 48.4	88 82	48	. 78	28	74	21	56	- 2	11
ll	52 43	87	40	82	35	. 78 77 70	28 31	66	13 24	56 65	zero	1
	59	92	52	84	49	82	26	79	20	60	14	10
<b>i</b>	54 60	92	45   (¹)	(1)	37	74 80	21. 31	8 <b>6</b> 9	23 20	56 59	<del>-</del> 6	4

 $\label{eq:APPENDIX35} \textbf{Monthly maximum and minimum temperatures and annual range of temperature (in$ 

[From self-register

Stations.	Jane	ary.	Febr	uary.	Ma	rch.	Ap	ril.	Ma	ay.	Ju	De.
·	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Mix.	Max.	Min.	Max.	Min.
	•	•	•	•	•	۰,	0	0	•	•	•	•
Abraham Lincoln, Fort,			٠									
Dak	38 58	-42 40	42 09	35 45	49 75	-15 43	74	16 36	84 72	22 47	90	46 48
Angel Island, Cal	69	42	82	14	61	48	86	46	81	48	88	51
Assinaboine, Fort, Mont	45	-45	51	-24	70	8	80	ii	87	iĭ	93	33
Barrancas, Fort, Fla	80	20	75	23	79	31	67	41	91	48	99	65
Benicia Barracks, Cal	57	38	69	41	76	47	82	45	92	. 53	. 83	53
Bidwell, Fort, Cal	57	2	66	21	75	20	75	31	(2)	(9)	(9.	(1)
Brady, Fort, Mich	36	-41	41	-39	39	<b>—27</b>	70	- 5	84	20	84	23
Bridger, Fort, Wyo Brown, Fort, Tex	50	-14	50	5	60	10	62	20	75	22	80.	20 70
Brown, Fort, Tex	80	29 50	84	36 -32	85 60	47	87	57	94	(¹)	95	(')
Buford, Fort, Dak Columbus, Fort, N. Y. H.	46 61	5	1 44	Zero.	56	1 7	(¹) 79	(¹) 27	(¹) 83	39	(¹) 91	52
Concho, Fort, Tex		_ ž	79	15	83	80	93	42	93	45	107	63
David's Island, N. Y	63	5	52	_ a	53	5	79	21	82	37	90	55
Ellis, Fort, Mont		-25	55	20	64	10	72	18	83	18	. 91	32
Fred Steele, Fort, Wyo	47	-21	47	14	62	- 5	72	10	79	28	87	29
laston, Fort. Cal	70	28	70	33	82	82	89	35	98	38	91	40
Ismilton, Fort. N. Y		_3	48	- 2	53	5	78	22	83	36	92	50
Keogh, Fort, Mont		-50	50	-28	64	2	80	21	89	17	97	35
Clamath, Fort, Orog		.4	72	8	69	17	76	13	85	19	85	27
Lowis, Fort, Colo Lvon. Fort, Colo		—14   —24	54 68	Zero.	54 75	13	68 84	16 24	77 96	31 33	79 97	20
Madison Barracks, N. Y	52	-30	40	$-5 \\ -21$	46	-21	77	16	83	29	86	39
Mason Fort Col		43	67	47	75	49	76	50	76	51	81	51
Mason, Fort, Cal McDermit, Fort, Nev	40	8	54	19	70	24	80	20	88	27	9i	81
McDowell. Fort, Ariz	77	16	81	20	98	36	98	81	110	46	108	53
McDowell. Fort, Ariz McHenry, Fort, Md	62	8	45	1	64	10	78	80	80	42	91	55
Meade, Fort, Dak	(1)	(9)	63	19	64	<b>—</b> 1	78	25	8.3	20	84	37
Mojave, Fort, Ariz		30	. 81	33	86	36	97	56	107	(1)	108	71
Monroe, Fort, Va Mount Vernon, Bar-	67	16	62	10	66	18	76	33	83	46	92	57
racks, Ala	76	16	81	15	80	25	91	34	91	46	98	50
Niagara, Fort, N. Y	52	- 3	40	-12	48	_3	78	18	78	29	82	44
Pembina, Fort, Dak		-46	40	34	41	-25	68	-12	84	22	89	34
Plattsburg Barracks,	"		-	"	·		•		"		"	
N. Y	52	-17	35	-27	46	-22	82	14	81	28	80	42
Preble, Fort, Mo	49	-10	39	-16	49	7	60	28	72	36	81	50
Precidio of San Fran-	ــ ا	۱		۱				۱				١.,
cisco, Cal	67 52	37	73	30	78	43	78	39	78	43	67	44
Randall, Fort, Dak Reno, Fort, Ind. T		-33 - 5	56 70	-25 Zero.	68	Zero.	81	18 33	90	25 37	98	34 54
Robinson, Fort, Nebr		<b>—25</b>	55	-24	69	Zero.		22	86	18	89	31
Saint Augustine, Fla		25	77	34	82	34	87	47	88	55	94	ã
shaw, Fort, Mont		-29	56	-10	71	i j	77	17	85	22	91	3:
Sisseton, Fort, Dak	40.	37	41	36	49	16	69	11	81	20	85	3
Snelling, Fort, Minn		-43	42	-31	50	<b>-</b> 7	74	16	86	25	87	33
Bully, Fort, Dak		-34	57	-26	67	8	81	23	89	27	95	31
Cotten, Fort. Dak	35	1-40	37	-35	39	-20	74	5	86	20	88	3.
Cownsend, Fort, Wash .	63	26	62	38	66	89	73	40	79	28	72	4
Union, Fort, N. Mex West Point, N. Y	65	-24 10	65	1-,6	60 53	- ⁷	75	24	82	32	92	37
Wingste, Fort, N. Mex.	49	- 6	8	8	(1)	(1)	8	(1)	(1)	(¹) 32	88	41
Yates, Fort, Dak		34	49	32	56	-10	76	20	89	24	93	3
	1 3	1	1 70	1	١ 🐃	1	, ,,	ı 20	1 0	~ ا	۳ ا	

¹ No record.

APPENDIX 35.

degrees Fahrenheit) at military-post hospitals for the year ending December 31, 1885. ing thermometers.]

Annus	mber.	Dece	mber.	Nove	ber. '	Octo	mber.	Septe	ust.	Aug	у.	Jul
range	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
•	•	•	•	•	•	0	•	•	0	•	•	•
14	-11	57	8	55	13	84	30	100	38	96	50	100
4	44	66	49	66	50 51	69 8 <b>6</b>	50	78 96	49.	70 84	48 49	70 93
14	43 —18	76 07	42 11	73 72		85	52 29	96	50 37	99	37	28
1	(1)		(1)	(¹) 75	( ¹ ) 53	(¹) 92	(1) 55 33	(1)	37 (¹) 53 53	(1)	C	(1)
6	43	(¹) 63	45	75	53	92	55	92	53	98	57	94
	15 —15	60 42	20 20	74 53	27 12	86 67	33 34	88 83	53 42	94 82	50 41	92 88
12 10	— 3 — 13	55	- 6	56	16	74	29	80	36	92	31	90
	(1)	(1)		88	55		68	94	70	96		96
	(1)	(¹) (¹) 59	(1)	(¹) 68	(')	(')	30	98	38	91 89	(1)	(¹) 95
	14 15	81	(¹) 26 25	88	55 (¹) 33 37	( ¹ ) 75 94	44 53	85 96	51 62	105	71 (¹) 57 65	106
10	11	56	24	66		44 1	42	84	47	90	60 38	97
12	15	58	6	70	22 11	82 75	22 31	91	33	95	38	97
11	-20	56	4	61		75 91		87 96	33 45	92   108	40 45	94
٤	28	69	(¹)	(1)	(1)	(1)	(1)		(1) T	(1)	(1)30	106
15	(¹) —15	(¹) 69	`'3	(¹) , 67	(1) 12 16	(¹) . 86	(1) 31 20	(¹) 99	(¹) 39 37	(¹) 98	( ¹ ) 48 29	104
8	14	52	11	57		91		90		96		96 i
10	- 2	57	12 20	63 80	• 17 24	75 85	30 38	82 96	40 51	89	41 54	89 105
12	- 6 8	75 54	5	71	17	72	28	78	40	102 83	44	90
1 18	43	64	48	65	51	71	51	77	50	80	53	74
١ ٤	5	56	18	65	26 30	86 104	35 52	92	46 67	102 116	47	94
19	20 15	83	34 33	94 70	38	74	47	111 84	52	91	70 60	114
	<b>—</b> 2	56 83 62 69	20	66	22 42	81	87	94	40	95	45	97 99
	32	76	41	85	42	103	59	112	53	115	58	115
1 8	21	65	35	78	41	80	48	86	62	93	56	95
30	27	72	26 25	80 63	35 31	85 75	54 40	93 82	61 50	99 86.	59   48	98 88
14	24	52 40	8	44	18	73	25	83	27	90	38	94
12	1	51	8	62	24	67	37	81 79	43	83 79	50	95
10	10	54	20	57	36	65	41		53		57	86
	39	66	(1)	(1)	46 20	74	47 33	88 93	48 39	83 91	48	78
14	-15 -2	61 72	9 21	66 85	20 28	83 88	53 52	92	53	89	43 61	107 98
10	— 2 —18	74	11	74	9	88 l	35	96	38	96	50	100
1 6	28	74	83	82	54	84	67	89	70	93 97	71	92
1	- 1	65	9 5	64 50	21 12	75 80	32 27	91 96	39 33	89	38 40	95 92
18	-19 -21	50 52	11	55	22	81	33	88	38	87	52	94
13	-21 -8	63	13	55	22 21 22	86	37	97	46	99	45	104
i	-22	i 41 i	4	45	22	80 69	29 42	97 75	37 46	88 85	41	92
	25	60 65	82 10	62 75	30 11	82	42 39	82	44	94	46 48	86 91
1 12	- 9 5	57	16	70	23	73	40	86	40	91	50	109
1	8	62	18	70	24	80	38	88	46	. 93	49	96
12	-15	56	8	58	8	87	30	98	41	97	38	97

¹ No record.

## APPENDIX 36.

Monthly and annual mean temperature (in degrees Fahrenheit) at military post hospitals for the year ending December 31, 1885.

[The daily mean is obtained by dividing the sum of the 7 a. m., 2, and twice the 9 p. m. (local time) observations by 4; the monthly by dividing the sum of the daily by the number of days in the month.]

	· · · · ·												
Stations.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Annuel.
	•	•		•	•	•			0	0	0	0	0
Abraham Lincoln, Fort, Dak.	8.4	-0.9		42.8		65. 8	72.1	63. 9	58.8	43.6	80. 0	22.7	<b>39.</b> 6
Alcatras Island, Cal	49.0	53. 2			56.2	55. 6		55. 9	56.6		56. 2	56.4	55. 6
Angel Island, Cal	50. 9 11. 1	55. 0 16. 7			60. 1 57. 4	61. 7 64. 8	61. 0 67. 5	60. 1 66. 1	62. 0 58. 2	60.3 46.7	55. 7 89. 3		58. 2 45. 4
Assinaboine, Fort, Mont Barrancas, Fort, Fla	52. 5	52.6			74. 9	83.9	(1)	(1)	(1)	(1)	( ¹ )	(1)	20. 2
Benicia Barracks, Cal	47. 2	54.8		58.8	62. 5	63. 0		67. 2	68. 9			50. 6	59.7
Bidwell, Fort, Cal	32. 9	40.0			(1)	(1)	70.6	72. 1	63. 3		41. 2	87.8	
Brady, Fort, Mich	5.4	4.4			50.0	58.8		58.8	55. 4			22.1	36.7
Bridger, Fort, Wyo Brown, Fort, Tex	21. 2 53. 4	27. 5 58. 6			46.7 77.9	55. 6 83. 8		63. 0 83. 2	54.3 81.1	44.3 74.3	83. 4 70. 0	26.8	43.0
Buford, Fort, Dak	_2. o	3.0			(1)	(1)	(1)	63. 5	56. 8		(1)	(4)	[
Columbus, Fort, N. Y. H	28.9	23. 1	29. 5	47. 5	56. 5	68.5	74.8	71.7	6L 5	54. 5	44.8		
Concho, Fort, Tex	37. 2	45. 7			71.1	84.0		86. 5	77.1			51.8	
David's Island, N. Y	31. 6 18. 9	23. 5			55.0 50.8	67. 5 58. 4			63.7			83. 4 31. 1	49. 4 43. 8
Ellia, Fort, Mont Fred Steele, Fort, Wyo	20.0	24. 2 24. 2	84. 2 32. 6		50.0	62. 2	69. 7	63.0	54. 4 57. 1	45.8 44.2		28.0	
Gaston, Fort, Cal	45. 3	50.9			63. 4	63. 4	73. 1	72. 0	65. 7			47.6	
Hamilton, Fort, N. Y	29.8	22. 9			56. 5		(1)	(¹)	(¹)	(7)	(1)	(1)	
Keogh, Fort, Mont	8.2	17.8			57.9	66.8	73.1	67.0	58. 2				
Klamath, Fort, Oreg Lewis, Fort, Colo	28. 8 17. 6	35. 5 26.7			52. 1 48. 9	54. 9 55. 9	63. 1 65. 8	62.7 64.1	52. 2 55. 4	47. 5 47. 9		34.8 29.4	
Lyon, Fort, Colo	17. 0	29. 8			60. 9	74.6		76. 8	67. 8			84.5	
Madison Barracks, N. Y	19. 6	10.6					69.8	63. 8	58.6		88.8		
Mason, Fort, Cal	53. 2	55. 6				61.8	60. 6	58.9	59. 9				
McDowell, Fort, Ariz	27. 6 47. 0	85. 8 52. 2		48.2	55. 1 75. 1	59. 3 83. 3		72.9 91.7	84. 0			34. 6 52. 8	
McHenry, Fort, Md.	80.7	24. 6			62.2	70. 5		72.9	64.8				70.1 52.7
Meade, Fort, Dak	(4)	12. 2		46.4	54. 2	62.2	71.2	65. 1	60.7	48.8			
Mojave, Fort, Ariz	48.7	58. 5	68.8	73.7	82.9	86.1	94.8	94.8	85. 8	73.4	61.8	55.8	73.8
Monroe, Fort, Va	40.6	85. 8		54.2	63. 7	73.4		77.8	70. 2				57.3
Mount Vernon Barracks, Ala Niagara, Fort, N. Y		49. 8 13. 5				81. 2 62. 7		80. 9 65. 9	77.6				65.9 42.9
Pembina, Fort, Dak	_10. o	9. 1	14.4			61.8		59. 9	60. 2 53. 7	88.6			
Plattsburg Barracks, N. Y		7. 2						64. 8	56. 5	46.0			
Preble, Fort, Me	21.0	17.7			53. 9	65. 6	70.6		58.0	50. 2	40.7	29. 2	
Presidio of San Francisco, Cal Randall, Fort, Dak	49. 7 9. 4	53. 5 13. 5			56. 6 59. 9	56.6			58. 5 63. 8		(1) 36, 8	52. 9 29. 4	
Reno, Fort, Ind. T.	25. 8	83.0		60.8		69. 2 75. 0			71.7	57. 5			46. 6 57. 2
Robinson, Fort, Nebr	19.4	22.6		47.0		66. 2		70.7	62.7	49.4		36.7	48.3
Saint Augustine, Fla	58.6	55. 0	58.0	68.0	73.8	79. 4	80.7	79.4	79. 2	69. 9	61. 2	52.5	
Shaw, Fort, Mont	17.0	24. 2		44.8		59.8		63. 1	56. 8		42.0	36. 2	
Sisseton, Fort, Dak Snelling, Fort, Minn	2. 7 0. 8	1. 4 4. 6		41. 9 43. 5		63. 2 67. 4	69. 6 72. 7	62. 8 65. 1	58. 2 59. 7	42. 6 43. 8	28. 4 84. 0	18. 7 21. 3	38.7 41.1
Sully, Fort, Dak		10. 6				67.7		67. 6	62. 7				
Totten, Fort, Dak	l8. 4l	-3. 8	18.7	89. 5	52.9	61. 8	67.2	61.6	56.4	40.5	26.4	14. 1	35. 8
Townsend, Fort, Wash Union, Fort, N. Mex West Point, N. Y	49.6	47. 0				60.3	65.8	63. 0	58.8			45, 3	
West Point N. Mex	29. 2	83. 5				64. 8		67. 4	63. 2	62.0		35.6	
Wingate, Fort, N. Mex	27. 9 28. 2	(¹)	26.7	[8]	(1) 57. 2	68.7 64.5	75. 0 70. 4	69. 8 67. 8	63. 9 62. 0			32.9 34.6	
Yates, Fort, Dak	2.2	(¹) 4.1	27.8		58. 2	66. 1	72.9	65. 6	60.0	43. 9			41.8

¹ No record.

### APPENDIX 37.

Monthly and annual mean temperatures (in degrees Fahrenheit) at stations on the Central Pacific and Southern Pacific Railroads and connecting branches, for the year ending December 31, 1885.

[The daily mean is obtained by dividing the sum of the maximum and minimum temperatures by 2; the monthly, by dividing the sum of the daily by the number of days in the month.]

No record.

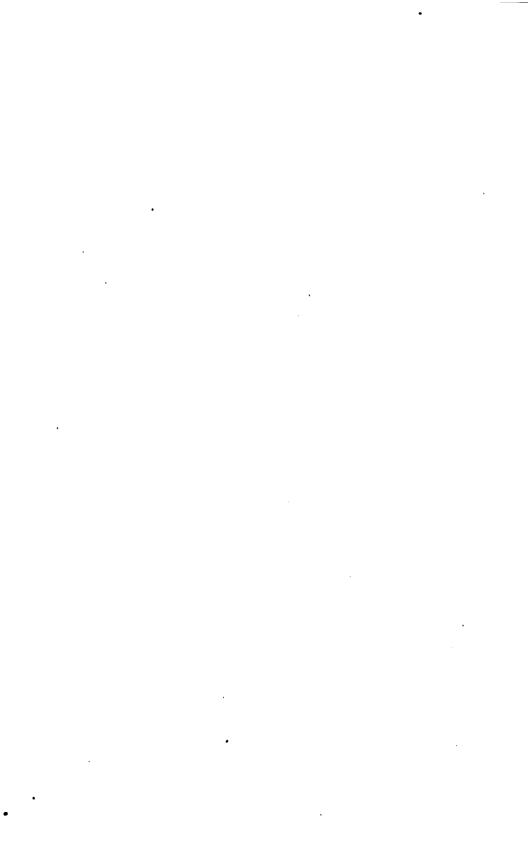
² Discontinued.

Monthly and annual mean temperatures (in degrees Fahrenheit) at stations on the Central Pacific and Southern Pacific Railroads, &c.—Continued.

Stations.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Annual.
Kingaburg, Cal	o 51. 6	o 56. 8	o 59. 4	o 61. 5	o 71. 5	73. 4	o 81.4	o 84. 5	o 77. 9	65.6	54.1	48.0	65. 5
Knight's Landing, Cal	50. 7	52.6	58.7	63. 9	67.3	69. 7	77.5	81.7	73. 2 73. 0	68. 2 63. 2	58.6 55.3	57. 1 50. 2	
Lemoore, Cal	46.7	53. 5 50. 8		63. 6	72.4	66. 1 71. 8	71. 2 81. 1	75. 2 83. 5	76.9	(1)	54. 6	51.0	01. 4
Livermore, Cal	54. 4	55. 5	55. 9	58.4	50.2	71. 8 57. 1	(¹) 85. 6	65.7	64. 6 76. 8	60.5	54. 4 52. 9	51. 2 40. 5	63. 8
Los Angeles, Cal	60.3	45. 2 60. 6	54. 4 65. 3	64. 4 66. 6	74.7 68.0	84. 1 70. 6	76 1	83. 0 76. 4	74L D		64.0	60. 7 61. 3	67. 3
Mammoth Tank, Cal	54.5	64. 4 56. 5 50. 4	67 0	78 8	85. 0 83. 0	90. 2 90. 5 64. 2 71. 5 63. 4	98. 6 93. 2	98. 2 92. 5	90. 5 86. 7	82. 1 75. 7 61. 4	68. 6 64. 1	61. 3°	78. 1 73. 6
Martines, Cal	46.8	50. 4	64. 7 56. 0 64. 9 55. 3	59. 3	85 A	64. 2	68. 2 82. 1	68. 1	67. 5	61.4	55. 8 55. 8	52. 6	59. 6
Marysville, Cal	(1)	56. 8 51. 6	64. 9	66. 6 58. 5	73. 8 62. 4 72. 7 76. 8	71.5	82. 1 68. 0	80. 9 66. 3	(¹) 64. 4	I RIK X	55. 8 54. 2	(¹) 49. 2	58. 3
Merced, Cal	50.7	55.3		64.6	72.7	73. 8	81.0	82. 9	75.5	70 8	59.8	51.5	67.0
Modesto, Cal	47. 9	54. 4	59.7	63. 4	76. 8	78.9	80.8	82. 2 85. 9	72. 1 76. 3	67.4	56. 0	51. 3 48. 0	65. 9 60. 5
Monterey, Cal	50.5	54. 4 52. 6 53. 5 51. 1 50. 7 53. 2	64. 7 59. 7 58. 7 55. 9	63. 4 59. 3 59. 0	68. 6 60. 9	73. 2 60. 2	60. 9	62.0	59.9	67. 4 64. 7 57. 8	52. 7 56. 6	53. 5	57. 6
Napa City, Cal	46.5	51.1	58. 1 57. 1	59. 4 60. 2	66.6	65 4	69.1	68. 2 79. 8	68. 5 72. 9	62. 0 64. 5	51. 1 55. 5	48. 9 56. 3	59. 6 62. 4
Niles, Cal	48, 1	53. 2	57.4	61.9	63.4	68. 1 63. 3	68. 9	68. 9	70.0	61.0	55. 0	49. 0	60.0
Dakland, Cal	49.8	53. 4 37. 1	56. 0 45. 0	57.8 56.3	58. 4 62. 5	58.4	62. 6 79. 8	63.3 77.1	61. 3 66. 2	58. 1 51. 6	57. 2 43. 1	51. 9 33. 6	57. 4 54. 1
Orland, Cal	52. 2	57.4	66.0	66. 8	75.7	75.7	83.7	87.4	79.6	72. 1	56. 6	53. 6	GN. 9
Pajaro, Cal Palisado, Nev	49. 8	50. 9 37. 2	56. 0 41. 9	58. 0 52. 2	60. 3 58. 6	59. 9 62. 8	64. 4 76. 4	62. 5 74. 4	61. 3 62. 0	59. 4 51. 3	56. 4 40. 6	54. 8 31. 4	57. 8 51. 0
Pantano, Aris	50. 7	58. 4	60.3	66. 0	75.8	80.3	84.7	84. 2	81. 2	.73. 3	63. 2	53. 3	68. 9
Petaluma, CalPleasanton, Cal	50. 4 49. 2	56. 0 55. 0	59. 0 58. 7	60. 1 62. 8	<b>62</b> . 8 <b>67</b> . 1	61.8 57.1	69. 2 73. 3	68. 5 (¹)	(¹) 76. 6	62.7	55. 8 57. 0	53. 0 51. 7:	
romontory, Utah	15.7	38. 1	44.3	55. 8	62. 9	70. 7 67. 1	79. 0	78. 5	67. 5	56. 2	44. 2	32.6	53. 8
Red Bluff. Cal	45. 1	48. 1 55. 1	54. 5 62. 3	59. 8 63. 9	65.7 71.3	67. 1 72. 5	74. 4 84. 2	79. 0 86. 9	72.3 78.1	62. 4 70. 1	52. 3 54. 0	52. 2 51. 2	61. 1 66. 6
Redding, Cal	58. 1	58.5	66. 5	63.0	73.8	(1)	(4)	82. 0 77. 3 77. 8	75. 4	72.2	58.7	48. 9 37. 6	<b></b> .
Rocklin, Cal	42. 3 45. 6	40. 0 58. 1	41. 7 55. 6	48. 3 58. 9	63. 0 66. 0	64. 4 69. 2 70. 8	76. 3 73. 5	77. 3 77. 8	62. 2 73. 0	51. 0 65. 6	40. 9	37. 6 60. 3	53. 8
Sacramento, Cal	(1)	54.6	60. 3	62. 6	69. 1	70.8	73. 5	75. 1	70.3	63, 7,	(¹) 54.8	50 2	
San Fernando. Cal	47. 6 53. 8	49. 0 58. 5	60. 9	61. 0 61. 1	61. 3 64. 1	61. 7 68. 4	68. 4 73. 7	61. 0 80. 9	62. 4 76. 3	54. 0 67. 0	54. 9 59. 4	49. 8 57. 4 51. 3	65.1
San José, Cal	49. 4	51.8	55. 5	55. 5	(1)	A1 2	65. 8 68. 0	65.4	64.6	61.6	56. 3 57. 9	51. 3 53. 6	
san Simon, Aris	41.8	51. 0 46. 7	53. 5 57. 8	56. 6 66. 0	(¹) 60. 2 75. 1	61. 2 81. 4 64. 5	85. 3	65. 2 81. 2	66. 4 (1)	61.3	60.0	(')	
Santa Cruz, Cal	52.7	54.5	58. 6 62. 9	60. 6 65. 8	62. 4			65. 6 70. 1	64. 7 67. 7	62. 5 64. 6	58. 4 61. 0	(¹) 54. 9 57. 2	60. 5
Soledad, Cal	47.5	(¹) 51. 9	56.8	(1)	63. 6	63. 7	65. 3	66.0	63. 9	59.6	54. 4 58. 5	50. 3	
Sorth Valleio Cal	58. 2	49. 0 57. 7	53. 9 61. 9	53. 9 65. 3	51.4 67.0	67. 0 63. 7 56. 5 67. 2 71. 0	58. 0 67. 3	54.7 66.2	60. 7 66. 1	59. 0 62. 4	58. 5 57. 0	50.7 49.6	55.0 61.7
padra, Cal	47.5	6	65. 6	66. 9	68. 2			79. 1	73.0	66.0	62. 0	61.8.	
stockton, Cal	47. 9	53.5	52. 8 60. 5	61. 3 62. 2	68. 2 64. 0 64. 4	67. 1 (¹)	('')	73. 2 70. 3	68.4 71.0	62. 6 62. 7	55. 3 57. 1	50. 8 53. 2	· • • • •
ommit, Cal	28. 1	54. 8 31. 6	36, 3	39. 2	43. 3	47. 2	69. 0 56. 0	58. 3	53. 8	62.7 47.7	57. 1 33. 5	32. 1	
Cocoma Nev	50. 6 23. 8	52. 7 35. 3	62. 8 45. 3	67. 3 59. 5	69. 6 63. 7	75. 4 69. 8	84. 2 81. 1	87.6 80.4	78.3 71.4	64. 6 59. 3	58. 6 41. 7	48. 6 33. 8.	55. 4
ohama, Cal	49.3	52. 9 38. 8	59. 9	62. 1	70.5	72.8	79.6	78. 0	73. 3	68, 5	41.7 59.9	33. 8 48. 0	64.6
'ennant. Cal	37. 2 48. 8	<b>38.</b> 8 <b>52.</b> 2	45. 0 57. 6	52. 7 60. 3	60. 9 63. 8	64. 6 63. 6	74. 2 68. 5	77.6 71.5	65. 1 71. 9	56. 0 65. 7	46. 3 (2)	44.4	55. 2
Corrace, Utah	25. 6	37. 1	43.3	57. 3	61.8	60.8	80.8	78.4	68.5	60.4	46.0	31.8	54.3
'oano, Nev	49. 3 19. 5	57. 1 32. 3	68. 0 43. 1	75. 5 49. 5	86. 2 52. 6	88. 7 59. 8	96. 9 77. 4	95. 9 71. 5	88. 3 60. 3	75. 4 50. 6	(¹) 36. 1	(1) 30. 2	48.6
'owles, Cal	(0)	(¹) 56. 3	(¹) 60. 7	(¹) 65. 3	(1)	(¹) 73. 5	70.6	75. 2 82. 9	62. 9 76. 4	62.4 66.2	46. 7 58. 0	45. 7. 51. 7,	
ruckee, Cal	27.6	34. 3	39. 8	42.8	76. 5 49. 8	52. 8	80. 1 62. 2	61.5	53. 8	48 9	36. 7	31.5	45.0
Kingaburg, Cal Knight's Landing, Cal Lathrop, Cal Lathrop, Cal Lemoore, Cal Livermore, Cal Livermore, Cal Lordsburg, N. Mex Los Angeles, Cal Marmoth Tank, Cal Maricopa, Aris Maricopa, Aris Maritopa, Cal Maricopa, Cal Marysville, Cal Menlo Park, Cal Menlo Park, Cal Modesto, Cal Modesto, Cal Modesto, Cal Modesto, Cal Modesto, Cal Monterey, Cal Neyball, Cal Novehall, Cal Dokland, Cal Dokland, Cal Dokland, Cal Prajaro, Cal Palisade, Nev Pantano, Aris Petaluma, Cal Promontory, Utah Ravenna, Cal Red Bluff, Cal Red Bluff, Cal San Marico, Cal San Mateo, Cal San Sumon, Aris Santa Cruz, Cal Santa Cruz, Cal Santa Monica, Cal South Vallejo, Cal Spadra, Cal Summer, Cal Corrace, Utah Corrace, Cal	49. 2	(¹) 59. 8	66. 3 64. 4	42.8 75.4	79. 1	52. 8 87. 4 75. 4	93. 4 85. 0	91. 1 87. 7	87. 8 77. 1	76. 5 70. 3	U4.8	52. 1 51. 3	68 9
urlock, Cal	49. 0	53.7	64.7	64. 8 68. 2	71. 1 76. 5	81.0	89. 2	87. 2	78. 1	65. 9	59. 1	56. 4	<b>69.</b> 1
Vadsworth, Nev	35. 0	46. 7 83. 0	50. 7 42. 3	55. 7 50. 5	( ¹ ) 56. 7	69. 5 63. 4	83. 2 (¹)	83.8 71.7	75. 1 62. 2	58. 5 44. 2	45. 2 39. 6	40. 0 30. 4	· • • • •
Villeox, Aris	39. 3	41.7	54. 5 60. 3	62.9	72. 3	75. 6	82.9	80.9	75. 4	63. 8	54. 3	48 3	62.7
Villiams, CalVillow Cal	46.8	54.6 47.2	60.3 65.8	62. 3 65. 0	72. 6 71. 6	75. 3 73. 1	82. 3 79. 2	85. 5 81. 9	76. 8 76. 9	69. 6 69. 0	54. 3 51. 0	48. 2 50. 5	65. 7 64. 7
Vinnemucca, Nev	32. 3	39. 6	46.4	53. 7	60. 8	63. 5	75. 5		(1) 73.8		40.00	34. 1	<b></b> .
Vacation J (C-)	47 7	55 4	63, 6	65. 5	72. 9	68.5	74. 7	77. 5	73 8	67. 6	(4)	53, 0	
nma Arie	21.71	55. 4 60. 1	71.4	74.8		84. 9	93. 4	94. 4	88. 9	67. 6 78. 5	ĠĠ. G	61. 2	

¹ No record.

² Discontinued November 1, 1885.



APPENDIX 38.

Monthly maximum and minimum temperatures and annual range of temperature (in degrees ing branches, for the year

From self-register

Stations	Janu	lary.	Febr	uary.	Ma	reb.	Ap	riL	M	Ay.	Ju	D6.
Stations.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min
	•	•	0	0	•	•	•	•	•	0	•	•
Alta, Cal	58	26	62	28	72	42	70	84	84	43	84	42
Anaheim, Cal	74	86	78	40	90	42	86	51	80	60	96	62
Antioch, Cal Aptos, Cal	64	28 32	70 72	36 31	75 82	43 36	80 78	46 45	76	52 50	88 90	58 55
Anburn, Cal	65	80	69	31	77	40	80	88	96	45	🚟	51
Sattle Mountain, Nev	50	12	56	24	72	26	76	80	90	36	94	40
lenson, Ariz	64	23	74	30	74	44	80	50	100	58	102	68
Beowawe, Nev	52	9	57	20	72	28	75	82	87	87	90	43
Bishop Creek, Cal	65	20	74	28	80	88	84 72	85 88	108	53	102 95	55
Blue Creek, Cal	60	zero	48 65	15 13	66 75	34 20	68	25	79 80	41 32	82	44 35
Borden, Cal	74	32	86	33	92	36	94	39	109	45	104	53
Breutwood, Cal	56	32	80	39	82	43	79	54	95	58	98	80
Brighton, Cal	66	83	72	84	80	46	86	45	100	56	92	57
Brown, Nev	50	12	64	26	76	82	83	88	96	40	96	48
Syron, Cal	62 72	28 82	74 84	32 34	82 82	38	90 83	46 44	110 96	56 50	98 96	58 52
Cabazon, Cal	60	82	82	38	80	46 48	80	42	104	50	106	56
Calistoga, Cal		29	71	31	82	85	84	80	97	46	90	45
arlin, Nev	44	4	52	16	64	24	72	30	86	34	92	32
asa Grande, Aris		32	76	36	84	51	94	55	104	59	107	68
hico, Cal	68	85	75	85	86	45	96	48	104	50	100	58
Chualar, Cal	75 40	30 14	75	85 (¹)	80 55	40 28	80 58	40 15	85 78	40 29	85 70	41
Cisco, Cal	62	34	(¹) 68	86	75	40	76	26	97	44	94	48
Celton, Cal	76	32	92	36	90	39	83	48	96	50	102	<u> </u>
orinne, Utah	51	4	55	12	74	27	78	45	87	42	93	40
Davisville, Cal	63	80	74	85	80	40	86	40	104	50	95	56
Oelano, Cal	70	36	82	86	84	46	90	52	105	55	98	61
Delta, Cal Deming, N. Mex	60 72	25 29	70 82	26 25	76 90	30 40	80 92	30 53	96 100	50 fil	96 106	50 ` 70
Dunnigan, Cal	62	82	68	39	76	50	85	50	107	51	96	58
iko, Nev	47	-4	66	20	67	21	68	25	78	40	89	27
El Paso, Tex	68	32	74	30	86	88	90	38	99	52	106	70
migrant Gap, Cal	49	20	59	26	64	83	64	25	80	32	78	36
Carmington, Cal	68	31	78	80	78	44	88 80	45 48	101	56 50	94 100	57 <b>60</b>
Fresno City, Cal Falt, Cal	75 64	34 32	75 70	31 33	80 76	39 38	83	45	106 98	60	100	53
liroy, Cal	66	31	74	30	84	38	82	43	99	50	86	51
olconda, Nev	72	ii	70	27	83	25	88	39	99	43	100	41
loshen, Cal	67	81	70	40	85	40	92	48	107	50	100	60
Ialleck, Nev	58	18	77	18	78	18	78	32	94	32	99	51
lawthorne, Nev	52	20	64	28	70	82	70	30 49	92 96	82 49	81	35 55
Iollister, Cal Iotel del Monte, Cal	69 65	82 35	75 68	33 35	85 81	40 41	85 76	43	77	52	80	52 52
Int Springs, Nev	66	6	71	10	83	24	80	36	90	40	93	48
Iot Springs, Nev Iumboldt. Nev	50	16	60	24	50	31	68	38	94	40	98	43
ndio, Cal	83	32	87	40	94	40	98	56	106	66	104	66
one, Cal	70	29	75	31	77	41	89	40	102	45	94	50
Keeler, Cal	()	(2)	68	82	72	43	77 80	47 84	95 94	52 39	94 95	58 35
Keene, Cal Kelton, Utah	64 50	27 2870	68 58	24 20	77 72	36 25	80	40	85	40	92	.X3
Koiton, Otan Kingaburg, Cal	79	zero 30	90	32	82	42	87	45	102	54	99	54
Knight's Landing, Cal	64	32	66	40	78	46	86	42	96	56	96	50
athrop, Cal	66	30	70	34	76	40	83	40	95	53	88	55
emoore, Cal	62	32	75	30	80	40	85	45	102	55	95 I	55

¹ No record.

# APPENDIX 38.

Fahrenheit) at stations on the Central Pacific and Southern Pacific Railroads and connectending December 31, 1885.

ing thermometers.]

J	uly.	Au	gust.	Septe	mber.	Oct	ober.	Nove	mber.	Dece	mber.	Annual
Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	range.
•	•	0	0	۰	۰	۰	•	•	•	•	0	•
(¹) 90	(¹) 64 60	(¹) 101	(¹) 56	(*) 106	56	88	48	94	44	86	40	70
96	60	100	62	94	60	88	47	84 76	43 37	(¹) 76	(1) 35	
96 80	50	85	50	90	45	80	40	78	37		` 35	59
96 98	5 <b>6</b> 60	103 100	58 54	97 92	54 44	93 84	50 26	73 70	38 18	67 56	29 10	74 90
105	72	103	70	98	62	90	47	81	30	72	22	83
98	65	102	50	91	40	83	25	72	18	62	11	93
109 107	72 68	107 165	70 59	99	53 51	88 79	42 34	70 60	24 27	67 43	20 11	89 107
95	40	100	40	85 94	28	(4)	(1)	79	15	60	10	107
112	65	118	65	i 109	59	106	(¹) 53	89	38	74	32	86
90 102	59	105	62	94 108 95	66	90	56	74	42	(¹) 69	(¹) 38	
102	61 72	109 104	60 61	108	56 50	98 87	50 85	83 76	40 28	60	25	76 92
106	62	112	60 62	100	50	98	44	78	84	(0)	(1)	
107	60	106	62	102	58	(¹) 90	(¹) 49	(¹) 78	(¹) 44	(¹) (¹) 66	(¹) (¹) 34	
102 90	60 54	109 106	66 48	100	54 48		49 35	78 70	44 32	66 73	34 31	77
94	47	104	50	101 94	38	99 86	18	72	20	60	zero	104
110	78	113	78	107	68	99	54	89	48	82	33	81
107	65	115	64	105	58	103	46	75	39	68	33	82
88 86	47 45	94	48 43	114 86	i 50 i 38	83 88	44 1 80	76 50	38 22	(¹) 48	(¹) 15	
100	55	88 105	58 65	100	(1)	95	48	64	36	72		72
110	60	116	65	112	(¹) 54	108	42	90	45	74	33	84
99 105	62 60	.103 112	50 62	86 108	43 62	73 106	29 50	62 82	20 39	50 69	6 35	84 107 82
105	60	(1)	67	105	60	100		(1) 70	(1) 30 30	69	35	62
106	64	(¹) 111	54 73	(1)	(¹) 60	(4)	(1) 54 48	`70	` 30	64	28	
108	74	108 112	73 60	100		94	54	l C4		86 58	23	85 80
104 98	60 49	98	48	100	59 88	100 84	48 18	74 68	40 20	52	32 zero	102
98 107	75	112	48 68	94 94	70	84	42	82	20 35	80	14	98
88	51	91	52	88	42	82	39	62	30	58	24	71
103 104	65 72	111 113	60 65	105	57 (¹)	103 98	45 48	78 76	40 38	70 68	33 40	81
100	62	108	50	(¹) 100	60	96	50	70	38	72	39	76
96	52	104	50	102	50	92	40	78	83	72	29	75
103 115	63 64	109 116	50 60 60	103 104	42 65	102 102	85 48	80 82	33 23 33	78 71	18 35	98
105	44	107	54	98	88	86	48 24	70	22	56	— 8	85 125
102	62	102	62	95	50	86	46	70	22 26	60	20	82
98 75	5%	108 76	53 53	95 102 72	52	102 72	42	72 74	42 38	76 73	34	71 46
90	54 58	103	58	96	44 38	90	41 20	74	38 14	68	35 16	97
90	60	96	58 56	84	45	80	29	64	31	62	26	97 80 82 79
108	72	114	76	108	62	104	54	90	85	81	32	82
104 101	50 72	107 103	62 70	100 95	56 57	90 85	45 54	72	35	62 61	28 35	79
97	55	103	51	95	47	95	44	(¹) 74	(¹) 40	78	80	78
95	50	104	50	90	45	68	80	60	15	60	(¹) 34	
105	64	111	62	104	57	96	44	70	30	68 70	34	81
102 94	58 58	110 102	58 55 <b>6</b> 8	102 99	56 52	100 94	48 40	86 74	40 37	65	40 35	78
104	65	105	68	100	52 60	94	45	75	35	75	30	81 78 72 75

² Discontinued.

Monthly maximum and minimum temperatures and annual range of temperature (in degrees

	Jant	ary.	Febr	uary.	Mai	rch.	Ap	ril.	M	sy.	Ja	ne.
Stations.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
			0	•		0	•	•	•	•	•	•
Livermore, Cal	84	28	84	34	86	40	84	42	98	48	84	48
Lordsburg, N. Mex Los Angeles, Cal		24 46	68 80	23 42	78 88	32 50	88 86	50 52	95 81	50 56	100 87	70 59
Mammoth Tank, Cal	8.5	39	91	49	95	50	105	58	124	65	118	74
Maricopa, Ariz	71	28	75	35	85	45	93	51	108	67	108	65
Martinez, Cal	GU	36	64	40	71	40	76	48	88	50	80	54
Marysville, Cal	(1) 64	(1) 32	76 72	34	83	54 88	84	50	98	58 49	97 81	49
Monlo Park, Cal Morced, Cal	70	36	78	32	74 88	40	83 90	40	92 102	46	96	54
Modosto, Cal	65	35	71	41	90	48	85	49	108	60	96	59
Mojave, Cal	73	25	72	32 .	76	80	85	40	105	45	100	45
Mojave, Cal Montercy, Cal	61	36	66	83	69	42	76	48	76	53	69	54
Napa City, Cal	60	29 24	78 82	32 28	81	32 40	89 89	82	96	41 50	89 94	53 50 53
Nowhall, Cal Niles, Cal	63	35	75	36	85 75	40	82	44 50	96	50	83	63
		38	61	40	70	44	74	46	70	48	70	50
Orden City, Utah	55	- 8	58	15	82	24	80	31	88	25	103	50 36 54 50
Orland, Cat	; 00	38	70	42	88	50	90	46	103	53	98	54
Pajaro, Cal	w	33	70	30	89	35	82	35	80	45	83	36
Parisade, Nev	46 82	- 5 30	56 86	10 30	70 90	22 45	76 92	80 40	86 101	38 56	98 102	62
Petaluma, Cal	70	32	78	34	82	88	82	44	92	48	78	52
Pleasanton, Cal	65	32	83	32	86	89	84	42	97	51	84	48
Promontory, Utali	48	-14	52	18	58	80	70	40	88	45	92	46
Rayenna, Cal	70	23	85	22	80	84	86	44	96	40	100	40
Red Bluff, Cal	! 70 ! 78	34 34	72 79	84 40	90 85	40 50	90 96	46 49	104 108	44	100	50
Redding, Cal	58	10	62	20	60	25	76	26	92	88	(¹) 92	(¹) 40
Rocklin, Cal	67	31	70	32	69	36	75	40	100	50	99	52
Sacramento, Cal	61	38	68	40	75	45	82	46	96	57	90	56
Salinas, Cal	64	30	70	84	70	40	85	42	80	50	74	52
San Fernando, Cal	75	37	84	38	86	42	90	46	92	53	91	53
San José, Cal San Mateo, Cal	68	35 34	68	36 36	80 75	40 41	76 72	40 43	86	48 50	78 75	50 52
San Simon, Atiz		26	74	26	78	40	86	44	92	60	96	70
Santa Cruz, Cal		38	74	38	82	45	80	44	84	49	83	51
Santa Monica, Cal	(¹)	(')	(1)	(')	70	<b>5</b> 5	88	55	80	58	95	60
Soledad, Cal		30	80	28	82	32	(4)	(2)	96	48	82	41
Soquel, Cal	74 66	36 42	76 70	82 42	84 72	40 50	78 82	86 54	78 89	36 53	84 78	38 57
South Vallejo, Cal		36	(1)	(')	89	. 48	94	51	85	56	89	50
Spadra, Cal Stockton, Cal	61	36	68	39	72	42	80	45	96	52	85	54
Suisun City, Cal	10	35	74	85	84	45	88	43	100	48	(1)	(i) 83
Suisuu City, Cal Summit, Cal Sumner, Cal	40	11	46	18	50	24	54	12	68	23	68	83
Sumner, Cal	77 42	33 10	76 54	31 20	88 65	44 80	92 78	45 40	104 85	50 49	97 89	55 49
Tecoma, Nev	61	32	70	36	82	40	88	34	102	40	98	52
Tehama, Cal Tehachapi, Cal Tennant, Cal Terrace, Utah	57	20	58	22	68	28	72	80	90	40	96	46
Tennant, Cal	70	31	71	26	93	34	85	88	102	50	86	47
Terrace Utah	58	- 4	68	20	72	18	80	38	84	40	94	40
Texas Hul, Aliz	10	24	84	28	94 68	43 32	100	55 89	119	70 35	115 85	82
Toano, Nev Towles, Cal	40 (¹)	(')	50 (¹)	16   (¹)	(¹)	111	65 (¹)	(1)	82   (¹)	(1)	(1)	1 65
Tracy, Cal	64	30	74	40	80	(¹) 42	90	(¹) 50	104	66	(¹) 96	(1)
Truckee, Cal	48	2	52	12	62	22	65	22	83	80	82	203
Tucson, Ariz Tulare, Cal	70	37	75	44	85	50	94	4.8	102	63	105	78 57
Tularo, Cal	70	33	76	40	85	49	87 92	50 42	105	51	90 101	60
Turlock, Cal	81	36 14	82 67	30 20	87 76	40 28	81	34	105	48	101	48
Wadsworth, Nev Wells, Nev	40	_10	50	16	64	20	70	82	(¹) 86	( ¹ ) 84	94 90	36
Willcox, Ariz	63	20	72	20	85	82	84	40	100	55	98	l 60
Williams, Cal	65	- 30	74	42	83	44	86	89	103	55	96	58
Willow, Cal	58	32	57	41	79	40	72	51	103	54	96	56 43
Winnemucca, Nev	53 68	10 34	60 76	10 35	76 82	24 45	75 84	82 48	100	40 56	84 94	52
Woodland, Cal		40	76	43	82 85	55	98	61	102	71	99	68
Yuma, Ariz	1 00	1 30	,	T-0	۳ ا	۳ ا	, ~	1 "	1 ***	ı '-	1	, ~

¹ No record.

Fahrenheit), at stations on Central Pacific and Southern Pacific Railroads, Se. - Continued

J	uly.	Au	gust.	Septe	mber.	Oct	ober.	Nove	mber.	Dece	mber.	Annual
Мах.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	range.
•	•		•	-				0	0	0		0
(b)	(¹) 76	105	48	106	50	104	40	73	30	68	36	
104	76	102	74 62	95	64	90	40	73	30	64	20	84
97	62	101	62	105	64	86	60	77	55	73	50	63
127 112	77 78	180 114	78 75	124 109	70 61	113 107	62 47	94 86	50 35	84 84	44 28	91 86
90	54	96	50	88	52	88	44	70	38	68	36	60
102	64	106	50 <b>6</b> 0	( ¹ )	(¹) 46	87	49	78	40	(1) 66	(¹) . 34	
94	51 58	96	51	95		88	39	70	35	66	. 34	64
107	58	112	51 58 55 67 55	106	54	98	42	80	36	76 64	38	80 75
103 105	60 67 50	110 106	67	100 101	51 60	96 88	44 48	80	40 30	80	35 28	81
72	50	78	55	73	49	71	42	83 74	37	73	35	45
95	54	99	54	95	45	95	39	75	34	65	30	70
106	52	112	60	108	55	102	45	83	34	80	32	88
90	55	97	55	97	50	83	45	71	42	67	36	62
80 103	56	80	54	76	52	66	46	68	44	66	44	42
103	55 56 58 62 55	105 110	55 54 55 62 54 52 69	92	45 60	84 99	28 54	68 67 72	22 44	56 78	10 38	.113 72
90	55	85	54	98 . 98	40	92	40	70	38	75	38	68
100	58 70	85 103	52	94	34	86	18	i es	38 22 42	48 79 68	10	108
104	70	101	69	100	34 70	99	59	89	42	79	32	74
104 95 96	58 59	103	50	(¹) 102	(¹) 58	89	42	89 77 72	36	68 68	35	
98	59 65	(¹) 105	(1) 58	90	58 52	( ¹ ) 78	(¹) 38	60	36 20	49	33 12	119
106	<b>5</b> 5	110	ı na	106	50	102	35	86	30	74	26	88
110	64	113	64	104	5.0	100	50	76	40	78	34	70
(¹) 100	(¹) 52	106	64 64 56	104	(1)	100	57	70	40	65	33	
100	52	101	56	88 100	(¹) 46	82	30	70	26	48	20	91
100	58 59	108	54 59	91	ı nz	96 88	43 46	(2)	(2)	84 62	38 40	
91 78	54	70	56	93	53	64	44	88	41 42	60	34	61
106	54 54	113	56	102	52 53 58	103	45	(¹) 72 68 82	44	80	38	63 76
86	l 50	95	54	98	50	90	44	1 74	38 43	66	34	64
88	58	92	56	92	54	82	46	74	43	69	40	58
111 88	72 52	98 90	68 51	(¹) 96	(¹) 48	93	(¹) 45	85 76	45 40	(¹) 76	(¹) 37	59
84	62	80	64	77	60	75	54	71	53	80	44	30
84 94 86	50	96	50	102	44	92	40	78	32	76	28	
86	40	80	40	78	42	78	42	76	50	76	36	54
82 102	58 56	86	55	90	50	83	50	70	50	70	82	58
103	26	108 102	60	114 95	50 54 53	104 90	50 44	84 68	45 38	87 60	37 40	
(¹) 95	(¹) 57	102	54 56	105	55	100	45	l en	40	68	38	
75	42	79	42	77	36	73	28	54 · 68 68	22	41	13	68
106	62	113	65	108	62	96	42	. 68	22 40	66	30	83
102	69	100	62	100	44	100	33	68	20	60	8	112
108 94	62 58	110 102	58 52	100 90	58	100 88	46 38	78 68	46 32	66 70	36	78 82
93	1 50	102	51	102	44 50	101	49	(2)	32	10	22	82
96	64	103 102	51 50 78 50	92	44	86	36	(2) 68	32	54	14	106
117	76	118	76	112	65	104	50	(1)	(1)	54 90	31	1
100	54	95	50	87	37	80	22	(1) 64 70 78 64	14	49	2	104
90 100	50 68	98 108	54 64	86 102	46 . 60	98	44 27	70	38	74	. 28	
92	40	108	40	86	34	83	24	18	38 20	68 48	38 11	78 90
107	83	109	80	104	80	93	61	85	49	63	43	72
107	<b>6</b> 8	113	65	107	53	99	51	83	42	73	33	80
106	61	114	58 68	104	55	98	40	80	40	80	35	84
102	. 68	102	68	98	44	88	32	74	20	60	20	
94 103	(¹) 68	98 100	58 66	84	42 55	61 95	27 37	65 80	19 28	45 77	12	108 88
102	65	110	63	95 100	60	100	48	75	40	60	15 38	88
99	60	109	63	101	60	99	53	75	42	60	40	77
94	62	101	60	i 90	45	85	36	68	21	56	15	91
102 107	59 81	106	53	99	45 55 73	96	49	(¹) 85	21 (¹) 50	64	42	
	. XI	109	82	105	1 73	97	65	I 85	i 50	80	45	69

² Discontinued November 1, 1885.

## APPENDIX 39.

Mean of the maximum and minimum temperatures (in degrees Fahrenholt) at the cottenregion stations of the Signal Service, United States Army, for the period from May to October, 1885, both inclusive.

[These means are obtained by dividing the sums of the daily readings of self-registering thermometers by the number of observations taken—one daily, at 5 p. m., Central time.]

	M	ay.	Ju	ne.	Ju	dy.	August.		September.		Oote	ber.
Districts and stations.	Max.	Min.	Max.	Mh.								
•	,	•	•	۰		•	•	•	•	•	•	•
Vilmington, N. C.:	83. 3	58.3	89. 3	66. 4	87. 1	70. 2	88.0	69. 2	78.4	62. 8		49.
Charlotte, S. C Cheraw, S. C	7 <b>6.</b> 8	58.5	84. 8	67.4	93. 1	69.7	89.8	69. 2	82.2	64.0	65.7 70.4	49.
Florence, S. C	82. 6	59. 9	89.7	68. 1	92.4	71.2	90.8	70.5	82.7	64.6	70.6	51.
Goldsborough, N. C Lumberton, N. C	78. 2 80. 8	58. 0 56. 8	86. 1 86. 7	66. 9 66. 1	90. 9 90. 9	71. 1 69. 2	88. 0 87. 9	70. 5 60. 4	81. 8 80. 4	64.7 63.8	68.9	52. 49.
Now-Berne, N. C	79. 9	57.8	87.1	65. 4	93. 9	69.7	87.4	67. 8	81.1	58.7	70.7	45.
Raleigh, N. C	79.3	56. 3	88. 8	64.3	92.7	69.0	89. 0	67. 0	81.7	6L 4	69.1	49.
Salisbury, N. C Wadesborough, N. C.	80. 9 81. 7	41.7	90. 7 90. 0	51.6 59.2	92. 8 89. 6	55. 8 62. 4	89. 6 89. 4	54. 8 61. 8	82.5 81.0	47.8 54.9	68. 5 66. 2	33. 40.
Weldon, N.C	76.7	58. 8	86.6	65. 0	92. 3	69.7	88.2	68. 6	82.4	60.0	(9)	( <del>0</del>
Wilmington, N. C	79. 0	62. 9	84.6	66.0	89. 0	78. 8	87.6	72.5	8L1	65. 8	70.9	52.
harleston, S. C.:	82. 8	60. 0	89. 2	68. 3	90. 8	71.5	88. 9	69. 8	82.9	65,5	70.6	52.
Branchville, S. C Charleston, S. C	79. 9	66. 4	86.8	78. 6	89. 1	75. 8	87.4	75.8	81.7	71.1	71.4	58.
Hardeeville, S. C	84.5	58.7	90.8	69. 1	93. 8	72.1	91.8	70.7	84.1	68. 0	78.1	53.
Jacksonborough, S.C. Kingstree, S.C	77. 4 82. 7	55. 1 57. 3	83.7 88.9	63. 5 64. 0	87. 7 92. 2	71.8 62.6	89. 1 90. 5	72.8 61.8	82.7	66. 2	72.2	53. (*)
Saint George's, S. C	84. 9	55.7	91.4	64.2	92. 6	67. 8	91.1	67. 2	(6) 83. 3	(5) 6L.5	720	46.
Saint Matthew's, S.C.	83. 2	59.0	90.1	68. 1	90. 9	70.8	88.8	70. 2	82.6	63. 8	72.8	48.
Yemassee, S. C	83. 8	58. 4	89.8	67.8	91.6	71. 2	89.4	70. 8	82.8	66. 1	72.3	51.
Allendale, S. C	82. 9	60.3	89. 2	68.5	91.7	71.4	89. 9	69. 6	82. 9	65. 6	72.8	52.
Athens, Ga	84.6	56. 4	94.2	65.6	95. 9	67. 0	90.5	68. 8	81.8	62. 9	66.5	46.
Augusta, Ga Batesburg, S. C	83. 0 82. 8	60. 5 60. 4	91.0 91.4	68.7 67.2	93. 5 94. 6	72.0 69.8	92.4 91.8	71.0 68.8	84.8 82.8	66.8 64.1	72.2 69.4	50. 49.
Blackville, S. C	82. 8	58. 2	89. 9	66. 9	91.5	70.5	89.7	69.5	81.8	66.1	70.6	50.
Camak (ia	84.2	55. 3	92.0	65. 2	96.0	68. 1	93. 6	67. 3	83.8	63. 2	69.9	48.
Chester, S. C Columbia, S. C	82. 3 80. 0	58. 0 60. 2	90. 3 88. 0	67. 0 68. 3	93. 4 89. 4	69.4 71.5	90.5 88.2	69. 2 70. 5	82. 8 81. 1	62. 8 64. 6	67.8 69.8	47. 49.
Greenwood, S. C	80.8	57.7	89.0	67.0	91. 3	69. 2	89. 3	67.7	81.0	61.2	68.2	45.
Union Point, Ga	77.5	54.9	85.7	63.8	89. 8	68.0	88.2	66. 4	79.0	62.0	67.6	46.
Washington, Ga Waynesborough, Ga.	83. 5 83. 8	58. 4 60. 1	91.7 91.4	67. 8 68. 3	96. 1 96. 3	70. 7 70. 5	93. 5 94. 4	70. 5 70. 1	84.9 82.9	62.7 65.6	72.0 70.5	50.
avannah, Ga.:	00.0	00.1	81.4	ا د.ت	50.0	10.5	01.1	.0. 1	-	٠٠		••••
Albany, Ga	84.3	63. 1	91.7	72.4	93. 0	78.1	90. 9	73.5	85. 2	71.0	73.5	54.
Allapaha, Ga Bainbridge, Ga	80. 6 83. 6	57. 9 65. 1	90. 3 90. 5	67. 9 70. 8	91.7 91.0	69. 4 71. 6	90.7 89.8	70. 5 73. 5	83.7 85.0	68.5 70.5	78.3 72.9	58.
Cedar Keys, Fla	81.7	69. 9	87.5	76. 5	87.5	76.5	87.4	76.1	85.7	74.8	75.4	63.
Eastman, Ga	83.9	59.0	91. 9	68.9	93. 9	72.5	91.8	71.7	83.8	67.9	72.8	52.
Fernandina, Fla Fort Gaines, Ga	80. 1 84. 5	67. 4 59. 9	88. 5 92. 4	73.0   69.2	88. 5 93. 0	75. 7 70. 2	89. 0 90. 5	73. 2 71. 4	84. 8 85. 0	78. 2 67. 5	78.4 70.5	63. I
Jessup, Ga	85.0	60.5	92.7	69. 3	95. 0	72. 2	92. 9	71.5	84.8	69.2	74.2	55.
Live Oak, Fla	86.0	60.6	92.0	69. 9	94. 8	71.9	91.9	71.9	88.4	70.4	76.9	55.1
Millen, Ga	85. 5 86. 4	59. 5 61. 3	92. 1 94. 1	67. 3 69. 6	95. 1 94. 6	69. 5 71. 5	92. 5 92. 3	70. 1 71. 8	84. 0 88. 6	65.9 69.7	72.7 75.4	50. ( 54. s
Savannah, Ga	80. 9	66. 2	86.7	72.8	90. 1	75.8	87.8	74.9	81.5	71.8	71.8	58. 2
Smithville, Ga	87.7	61.8	95. 1	69. 5	98.1	70.1	95.8	79.6	87.5	71.0	75.0	51. 4
Thomasville, Ga Waldo, Fla	83. 3 87. 1	61.3 58.3	90.3 91.6	68. 2 70. 7	91.3	69. 7 71. 6	91. 8 93. 0	70.1 67.4	88. 4 89. 5	68.5 68.0	75. 2 79. 2	54. 2 55. 7
Way Cross, Ga	83. 5	61.9	91.5	70.4	93.7	73. 5	92.2	72.1	86.6	70.0	75.3	56.
tlanta, Ga.:	- 1			- 1		- 1		1	1		- 1	40.5
Anderson, S. C Atlanta, Ga	83. 2 74. 8	55, 2 59, 0	92. 4 84. 0	65. 8 69. 3	95. 0 86. 5	68. 2 71. 1	90. 4 84. 6	67. 6 69. 8	81.5 76.3	61.6	66.2 64.9	46. 2 49. 6
Cartersville, Ga	77.1	53. 3	90.2	65. 7	91.6	68. 2	88.6	68, 1	80.2	63.8	66.8	46.7
Columbus, Ga	76.5	60.3	86.0	69. 6	84.0	72.0	86.8	71.1	79.6	68.7	67.9	53, 4

⁶ No record.

Mean of the maximum and minimum temperatures (in degrees Fahrenheit) at the cotton-region stations, fo.—Continued.

	M	ay.	Ju	ne.	Ju	ly.	Aug	gust.	Septe	mber.	Octo	ber.
Districts and stations.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
	•	•	•	•	•	0		•	•	•	•	
Atlanta, Ga.—Continued:	79.0	58. 5	88.4	63. 4	91. 1	66.9	87.8	65.8	80.0	60. 5	67.0	44.
Gainesville, Ga Greenville, S. C	81.1	52.5	91. 2	64. 9	92. 5	66.9	87. 8	67.4	80.8	61.3	63. 9	46.
Griffin, Ga	78.5	59. 8	86.7	68.8	89.2	70.9	87.6	70.1	79.8	65. 5	67. 9	50.1
Macon, Ga Newnan, Ga	83. 8 81. 4	59. 8 58. 4	91.7 89.9	69. 6 67. 3	94. 1 92. 7	71.2 69.7	91. 7 90. 5	70.8 69.6	83. 2 83. 0	67. 1 63. 9	70.3 69.1	50.9
Spartanburg, S. C Toccoa, Ga	83. 2	50.9	89.6	65. 9	92.1	68. 2	90.8	68.5	83. 9	61.3	71.5	46.
Toccoa, Ga West Point, Ga	80.5	54. 4 65. 7	89. 7 89. 0	64.2	90.7 91.5	66.1 70.4	87. 6 89. 3	66. 1 70. 1	79.3 81.3	61.0	65.6	46.
fontgomery, Ala.:	1	l		W. 1	1	10.3	Į.	i	l	00.5	į.	70.
Birmingham, Ala	80. 4 85. 6	52.0 54.3	90.6 95.8	61.7	92.7	67.0	92.7	69. 2	83.7 87.8	65.5	70.6	47.
Calora, Ala Eufaula, Ala	L 80. 0	60.1	90.4	65.0 69.2	94.7	66. 1 70. 8	94. 1 88. 7	65.9 71.3	81.2	60.8	71.5	51.
Fort Deposit, Ala	81.8	71.0	89.4	71. 2	90. 5	70.5	88.8	68. 2	83.8	63. 3	70.7	45.
Fort Deposit, Ala Greenville, Ala Marion, Ala	82.0	74. 3 56. 6	89. 5 96. 8	79.0 66.2	91.7	73.8 66.5	89. 9 95. 6	70.6 67.2	85. 4 84. 2	67. 9 56. 9	72.0	59.
Montgomery, Alb	. 180.8	61.5	90.6	70.4	91.0	71.7	89. 3	72. 2	83. 1	68.2	(¹) 70.7	52.
Opelika, Ala	. 80.6 . 81.8	58.4 57.8	89. 2 93. 0	67.4	90.6	74.4	88.0	72.9	78.7 86.3	60.4	68. 1 72. 9	49.
Pine Apple, Ala Selma, Ala	80.1	59.0	90. 6	66. 2 68. 6	93.5 91.6	67.3 72.1	91.2 90.5	67.5	84.7	63. 9 67. 6	72.3	46. 50.
fohile Ale:		ĺ	į	Į.	ł		ı	1			1	1
Aberdeen, Miss Columbus, Miss	.   81. 1 .   84. 0	58.1 59.2	89. 9 95. 8	68.3 71.6	91.3	63.8	91. 5 95. 0	64.0 69.8	84. 2 86. 5	63. 9 66. 1	71.1	47.
Evergreen, Ala	.1 (1)	(¹) 67. 7	(1)	(¹) 77.0	(¹) 95. 2	(¹) 74.7	90. 32	76. 12	85.8	74.3	72.7	57.
Livingston, Ala Macon, Miss	.   85. 0 .   83. 2	57. 7 58. 5	94. 0 95. 0	77.0 68.2	95. 2 95. 0	74.7	93. 7 91. 0	71.6 70.4	86. 5 85. 9	67.1 64.0	74. 3 75. 0	49. 47.
Meridian, Miss	. 182.5	61.5	93.7	71.1	94.6	70. 6	92. 5	70. 6	86.0	68.3	72.5	45.
Mobile Ala	180.2	64.1	88. 2	71.0	89.8	73.0	88. 4	73. 3	84.6	70.9	72.9	54.
Okolona, Miss Waynesborough,	. 84. 2 83. 7	63,8	92. 9 91. 3	73. 9 69. 1	96. 9 92. 2	73.8	95. 6 91. 1	71.9	88.3 83.4	66.0 67.3	72.8 72.6	49. 49.
Miss						'			,	****		
lew Orleans, La.: Alexandria, La	81.1	62.4	92. 2	68. 7	93. 8	71.6	89.7	71.0	84.8	68. 6	72.7	48.
Amita City La	83 8	58. 5	91, 6	68. 2	87.7	70.4	87.8	67.1	80.6	68.0	71.5	49.
Brookhaven, Miss	. 83.4 . 84.2	58.8 61.5	94.0	67.5	93.3	69.5	91.2	69.4	84.8	66.5	71.9	48. 49.
Brookhaven, Miss Cheneyville, La Coushatta Chute, La	80.5	59.7	95. 2 89. 8	68. 2 68. 5	96. 0 91. 0	70.0	95. 6 91. 0	69.6 70.5	88.7 85.9	66.4	77.8	48.
Haslehurst, Miss Lafayette, La	. 89.1	60.4	99.1	68.3	96.8	70.1	91.4	70.1	84.8	66. 6	72.1	50.
Minden, La	. 82. 5 . 83. 9	64.6 57.6	91.5 94.8	70.6 68.8	91.5 95.4	73.1	90.3	72.6 69.5	85. 1 86. 4	65.4	76.4 73.2	52. 47.
Natches Miss	. 1 88.0	61.0	92. 2	69. 2	92.5	71.6	89.6	70.8	84.0	67.9	73. 2	50.
Natchitoches, La New Orleans, La	. 80. 8 . 80. 5	68.4	91. 2 89. 0	69. 6 76. 8	91.6	72.9	90.3	71.9	83. 7 85. 2	67.9 72.8	73.5 73.6	49. 58.
Opelouses, Le.	.184.2	62.6	95. 1	69.1	95. 3	76.9 71.6	92. 9	74.8 70.5	85.7	67.7	75.4	49.
Port Gibson, Miss Shreveport, La	- (4)	(1)	(1)	(¹) 72.8	95.0	71.2	93. 2	70.5	85.6	66.0	74. 9	48.
alveston, Tex.:	1	62.8	93.4	72.8	95.7	74.2	92.7	73.8	85. 2	68. 5	72. 5	51.
Austin. Tex	. (1)	(1)	95. 1	72. 2	95.3	75.5	96. 2	76.3	89. 5	69.5	75.8	56.
Beiton, Tex	. 80.9	57.5	92.9	54.8	95.7	45.2	97.5	64.3	90.2	69.4	82.4 78.4	55. 55.
Columbia, Tex	82.2	66.4	(¹) 88. 7	(¹) 72.8	91. 2	(¹) 72.9	91.4	72.5	85. 5	70. 2	77.5	55.
Columbia, Tex Corsicana, Tex Cuero, Tex	. 88. 1 . 86. 5	53.7	94.8	62.7	1 96. 2	65.5	95.7	66.6	87.9	59.3		45.
Dallas Tex	83.5	64.5	97.0 94.1	72.0 67.4	95. 6 98. 7	73.5 72.5	96.3 97.6	73. 0 72. 1	89. 2 89. 0	70. 2 66. 0	80.4 76.7	54. 50.
Galveston, Tex	81.8	70.6	88.7	79.0	90. 2	79.7	88.8	79. 2	84.5	75.1	75.2	63.
Cuero, Tex Dallas, Tex Galveston, Tex Hearne, Tex Houston, Tex Huntsville, Tex Longview, Tex Luling, Tex Orange, Tex Palestine, Tex San Antonio, Tex Sour Lake, Tex Tyler, Tex Waoo, Tex	82.5	59. 2 65. 5	93. 4 89. 5	69.7 71.8	96. 7 90. 0	72.0 78.0	96. 9 89. 8	71.3 72.8	90.0 86.6	68.8 70.4	72.6 78.3	55. 58.
Huntsville, Tex	82. 2	61.7	92.7	70.9	93. 2	78.3	94.0	72.6	90.6	68.6	76.6	53
Longview, Tex	. 82. 2	8	99. 8	64. 4 76. 7	94.7	70.6	94.9	72.8	90.4	70.1	75.2	49.
Orange, Tex	. 83.84	69.44	92. 2 90. 8	79.8	92. 1 92. 5	75.0 80.4	96. 0 91. 1	76. 2 77. 1	(¹) 86. 1	72.8	81.9	69.
Palestine, Tex	. 79.5	61.8	89. 4	70.9	(1)	(1)	91.6	78.2	84.8	68.0	72.3	52.
Sour Lake, Tex	81.4	63. 6 ¹ 64. 8 ²	91. 4 91. 8	71.1 68.7	89. 8 94. 0	71.4 70.3	94. 2 92. 2	72. 2 70. 4	88.7 87.7	69. 5 68. 7	79.1	55.
Tyler, Tex	82.5	58.0	93.6	68.8	94.7	72.5	94. 1	70.5	87.7	66. 5	79.0	(¹) 50.
Weatherford Tex	70 0	61.0 50.8	92. 6 88. 6	71.7	93. 8 96. 7	71.7 60.9	94.8 94.0	71. 9 60. 6	85. 8 84. 3	68. 6 54. 7	71.8 75.2	53. 43.
Weimar, Tex	83.7	63. 1	94. 6	58.0 71.8	94.5	73.6	96.6	73. 1	89.7	70.6	81.0	54.
Weimar, Tex Vicksburg, Miss.: Edwards, Miss Jackson, Miss	00.0	1	1		1	1	ł	l		87.4	72.3	40
Jackson, Miss	. 83. 2 . 84. 2	61. 2 59. 2	92. 9 94. 1	71.0 68.4	93. 5 93. 3	72.3 72.4	89. 4 92. 4	70. 2 69. 5	84. 5 85. 3	65. 4 66. 6	72.1	48.
THE COUNTRY OF THE PARTY OF THE	. 1 82 8	54.2	92.9	58.8	92.7	58.4	91.4	64.1	83. 9	64.5	72.6	44.
Monroe, La	. 80. 1	60.9	91.2	70.3	93.4	72.8	91.3	71.0 71.6	84. 7 83. 4	66.7 67.3	72. 2 72. 0	49. 52.
Vicksburg, Miss little Rock, Årk. :	. 81.2	62.5	91.6	74.2	92.4	72.4	90.3	11.0			1	1
Arkansas City, Ark	(1)	(9)	(1)	(1)	95. 5	73.3	91.4	71.0	82.7	66.1	68. 2	49.
Brinkley, Ark	.   81. 9	55.5	91.6	66. 2	96. 5	71.8	94.8	67. 6	86. 5	62.5	72.5	44.
Devall's Bluff, Ark .	79.2	52 A	1 80 5	R5 1	102 4	167 9	922.1	64.2	84.1	1 39. /	1 72.0	42.

Mean of the maximum and minimum temperatures (in degrees Fahrenheil) at the cotton-region stations, &c.—Continued.

<b>.</b>	M	ay.	Ju	пе.	Ju	ly.	Aug	gust.	Septe	mber.	Octo	ber.
Districts and stations.	Max.	Min.	Max.	Min.								
Little Rock, Ark.—Con'd:	•	0	0	۰	0	•	0	o	•	•	•	0
Fort Smith, Ark	76.8	56.7	86. 3	67. 9	91.8	71. 2	89. 1	68. 2	83. 1	62.6	71.3	47.4
Helena, Ark	80. 2	57.1	91.6	68.8	94.0	71.5	91. 5	68. 6	83.7	63. 2	69. 9	46.3
Kensett, Ark	73. 11	56.71	83.1	67. 2	87.5	69.6	86. 3	65. 1	78.3	61.0	63. 5	45.9
Little Rock, Aık	77. 9	60. 1	89.0	71.8	94. 2	75.4	91.0	72.7	83. 1	67.0	70.8	52.0
Madison, Ark	83.0	53.6	91.5	65. 6	97.3	67.4	96. 5	61.3	88.8	56. 1	77.9	38.5
Magnolia, Ark	83.3	56.0	93.7	69. 2	95. 2	71.9	93.8	70.6	86.8	64.6	73.8	46.9
Malvern Ark	82.0	51.8	94.4	66. 9 66. 7	99.3 93.8	66. 2 72. 5	95. 3 93. 7	62. 0	86. 0 86. 0	60.0	74.3	44.9
Monticello, Ark Newport, Ark	79.8   80.1	57. 0 57. 4	92. 1 93. 5	67.0	93. 6	71.6	90.8	70. 2 67. 7	85.6	64. 1 62. 7	71.8 68.5	46.6
Paris, Tex		53.0	90.4	64. 2	93. 5	65. 3	92.9	64.6	85.4	58. 2	74.6	49.8
Pino Bluff, Ark		51.1	90.1	65. 9	93. 7	72.1	92.7	70.1	(2)	(7)	(7)	(2)
Prescott, Ark	81.1	49.6	93. 4	61.5	97.0	62.7	93. 7	61. 5	86.2	56.2	74.8	41.2
Russellville, Ark	75.8	56. 6	90.9	67.4	92. 1	68. 5	94. 2	67. 6	85. 9	62. 2	72.6	44.8
Texarkana, Ark	81.9	43.8	88.9	67. 1	92.3	71.7	92. 3	70.5	86. 4	65. 8	75. 5	48.1
Memphis, Tenn.:	1	l	l		l	ĺ		l	į	١.		Į.
Arlington, Tenn	79.9	64. 1	89.8	65. 2	92.5	67. 2	91.8	57.8	86. 2	55.8	71.9	37.2
Batesville, Miss	81.0	56. 4	83.8	68. 3	95. 5	70.6	92. 6	67.7	82.8	64. 2	70.6	46.8
Bolivar, Tenn	76.6	54.7	87.0	66.9	89.8	71.9	90.6	66.7	83.1	61.5	70. 1	46.7
Brownsville, Tenn	79. 2 80. 1	57. 0 54. 2	89. 1 88. 2	67. 6 67. 9	91.4 92.6	70. 6 68. 5	90.7	67.5	83.9	61.8	69. 2	46.8
Corinth, Miss Covington, Tenn	79.1	55.7	89.4	67.1	91.6	69.7	90.6	65. 1 66. 3	84. 4 83. 9	60.5	(3) 69, 5	46.0
Decatur, Ala	80.4	54.8	91.9	65. 7	93.0	69. 4	91.6	68.6	82.5	62.7	69. 9	45.6
Dyersburg, Tenn	76.3	55. 2	86.3	66.3	89.7	69.7	88.2	66.5	79.8	60.4	64.4	44.7
Grand Junction, Tenn		56.4	88.3	67. 3	89. 7	69. 9	90.6	67.3	83. 1	62.9	68.3	47.6
Grenada, Miss	84.5	52. 1	93. 2	59. 2	94.5	68.6	92.8	63. 4	86.4	60.8	(F)	(2)
Hernando, Miss	82.9	56.8	91.0	80.4	96. 4	80.8	90.6	71.6	81.7	62.5	65. 2	44.8
Holly Springs, Miss .	77. 9	59. 3	89. 1	70.3	90.6	70.7	90.4	69.3	82.0	64.5	67.5	48.1
Memphis, Tenn	77.6	56.7	89. 0	70.7	90.8	74.9	89.=0	72.0	81.6	66. 1	68.3	52. 8
Milan, Tenn	80.7	55. 1	92.1	66. 7	92.5	68.7	92. 2	66. 1	84.3	59.8	69. 3	44.7
Nashville, Tenn	75. 1	57.3	84.3	68.5	88. 1	71.2	87.4	70.1	80.0	65.5	66. 4	51.0
Oxford, Miss	79.4	56.6	90.7	68.3	93.0	70.9	92.0	68.7	83.8	65. 3	70.6	46. 9
Paris, Tenn	73.4	47. 9 55. 8	87. 4 87. 3	57. 1 65. 7	89. 9 89. 1	65. 5 68. 5	89.5 88.3	63.4	82. 2 81. 0	56. 2 60. 5	67.3 68.1	44.6
Scottsborough, Ala Tuscumbia, Ala	77.9	54.6	90.1	65.6	90.5	69.5	91.6	68.9	82.8	62.6	69.5	46.8
Tuscumon, Ata	11.9	04.0	30.1	05.0	30.3	03.3	91.0	UO. 9	05.0	05.0	1 05. 5	90.8

¹ For 24 days.

² No record.

[.]ª Record incomplete.

### APPENDIX 40.

Average temperature (in degrees Fahrenheit) of the surface of the ocean at stations of the Signal Service, United States Army, on the Atlantic and Gulf coasts for each month of the year.

[Computed from observations taken at 2 p. m., daily, from the date observations began, to December, 1885, inclusive. Prior to January 1, 1885, observations were taken on Washington time; from January 1 to December 31, 1885, on 75th meridian time.]

Stations.	Observa begr		January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
Eastport, Me. Portland, Me. Boston, Mass. Block Island, R. I. Now London, Conn. New Hoven, Conn. New York City Sandy Hook, N. J. Atlantic City, N. J. Chincoteague, Va. Norfolk, Va. Fort Macon, N. C. Wilmington, N. C. Smithville, N. C. Charleston, S. C. Savannah, Ga. Jacksonville, Fla. Key West, Fla. Cedar Keys, Fla. Mobile, Ala Galveston, Tex. Indianola, Tex.	May, Dec., May, May, Apr., May, May, Dec., July, Dec., Dec., June, Dec., June, Dec., June, May, May,	1874 1873 1881 1881 1874 1881 1873 1881 1880 1873 1873 1873 1874 1874 1874 1874 1874 1874 1875 1874	o 35. 93 38. 4 38. 0 37. 1 1 36. 0 0 38. 4 47. 7 5 50. 7 49. 9 55. 3 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50. 8 50.	37. 0 40. 9 44. 5 52. 0 50. 4 51. 1 53. 2 53. 4 61. 0 73. 6 63. 7 60. 4 54. 8 57. 2	36. 5 38. 4 35. 6 38. 6 38. 7 43. 0 49. 5 54. 0 55. 4 57. 9 66. 4 75. 7 66. 6 59. 1 63. 8	42. 4 42. 5 46. 6 45. 4 43. 6 47. 7 52. 4 56. 1 62. 5 62. 5 62. 1 64. 2 64. 6 71. 8 72. 6 71. 0	73. 1 78. 3 82. 8 79. 0 78. 0 74. 8 78. 2	86. 1 83. 4 83. 3 82. 4 84. 4	72. 1 80. 0 80. 9 81. 8 83. 8 83. 1 83. 6 84. 5 86. 6 87. 4 85. 9 85. 2 85. 8	61. 0 64. 9 67. 2 71. 9 73. 3 73. 3 73. 8 73. 8 80. 5 81. 5 85. 6 85. 6 85. 6 85. 8	57. 8 62. 3 64. 5 67. 7 68. 4 69. 3 70. 3 71. 1 75. 2 77. 0 78. 0 78. 9 78. 4 82. 3 86. 1 84. 2 81. 6	52.3 54.7 59.8 60.1 61.4 62.3 66.2 65.3 70.6 71.1 75.3 81.4 76.9 74.2 75.5	49. 8 49. 6 46. 7 48. 5 51. 3 52. 3 51. 8 54. 4 61. 3 59. 5 60. 2 67. 3 76. 6 64. 9 63. 4 64. 3	36. 9 35. 9 41. 7 40. 4 87. 1 38. 4 41. 9 41. 4 41. 8 44. 0 51. 8 .49. 9 53. 0 53. 2 50. 6 59. 0 71. 2 60. 6 57. 5 53. 5 7. 6

# APPENDIX 41.

Normal precipitation, and departure of 1885 therefrom, at stations of

[The normal has been computed from the commence

	Jan	uary.	Febr	uary.	M	rch.	A	pril.	м	ay.
Districts and stations.	Normal.	Departure +or	Normal.	Departure +or	Normal.	Departure +or-,	Normal.	Departure + or	Normal.	Departure
New England: Eastport, Me	In. 3. 81	In. +0.55	In. 4. 13	In. -1.18	In. 5. 35	In. +0.59	In. 8, 80	In. +1.55	In.	In.
Portland. Me. Mount Washington, N. H. Boston, Mass. Block Island, R. I	8. 30	-0.28		+0.42	8, 14	-1.55	2.98	-0.89	3. 16	-1.
Mount Washington, N. H	4. 24 4. 26	+1.25		-2.12 -0.64		-5. <b>39</b> -8. 56	5. 59 4. 01	-2.93 -0.71		-4
Block Island. R. I	5. 28	+0.02		-2. 23			3. 40	-0.75	4.89	+0.
New Haven, Conn	9. 22	-0.17	4. 25	-1.10	4.89	-3.70	4.02	-1.71	3. 60	-0.1
Now London, Conn		+1.23	3. 66	+0.37	4.82	-3. 27	8. 87	-0.53	8.56	+1.4
Middle Atlantic States: Albany, N. Y Now York City Philadelphia, Pa Atlantic City, N. J. Barnegat City, N. J. Cape May, N. J. Sandy Hook, N. J Baltimore, Md Washieston City	2.77	+0.32	2, 72	-1.84	2, 75	-2.13	2.81	+0.08	2.87	-0.1
Now York City	3. 67	-0.32	3, 55	+2.54	3. 90	-2.71	2. 16	-0.72	2.82	-0.7
Philadelphia, Pa	3. 38	-0.46	3. 19	-0. 22	3. 19	-2, 50	3, 00	-0.46	2.89	+0.1
Atlantic City, N. J.	4.00		8, 34	-1.34	8.87	-2.92	8. 49	-1.81	2. 39	+1.
Barnegat City, N. J	4. 93 4. 37	-0.59 +0.61	3. 52 3. 79	-2. 05 -0. 08		-4.43 -2.68	3.50	-2. 67 -1. 29	2.54	-1.6
Sandy Hook, N. J.	4. 32	+0.26	8. 60	+0.94	4. 99	-4. 32	4. 38	-1.91	3.97	+1.
Baltimore, Md	3. 17		3.37	+1.03	3. 94	-2.34	3. 07	-1.70	2. 95	+1.
Washington City	3.41	+0.05		+1.39	4.09	-2.56	2.90	-1.19	2.98	-a:
Capo Henry, Va	4.96	-1.60 +1.26		+0.13 -1.78	5.89	-3.38 -1.76	5. 16 2. 58	-8.71 -1.61	3. 33 8. 42	+1.
Lynchhurg Va	4.46	+5.31	8. 44	+0.05		-2.66	8.40	-2.01	8.05	+2.
Baldmore, Md Washington City Cape Henry, Va Chincotesgue, Va Lynchburg, Va Norfolk, Va	4.04	-0.01	8. 90	-0.11	4.58	-1.54	3. 97	-2.05	3.56	+2
outh Atlantic States: Charlotte, N. C. Hatteras, N. C. Kitty Hawk, N. C. Macon, Fort, N. C.				j			- 1		- 1	•
Charlotto, N. C	6. 50	+2.40	4.64	-0.10	5. 27	-2.36	4. 55	-1.72	3. 83	+3.
Ritty Howk N C	6. 63 6. 06	+1.35 $-0.61$	5. 19 8. 97	-0.69 $+2.20$	7. 47 6. 05	-8.75 -2.57	5. 54	-2.38 -1.64	4. 18 8. 27	+2.
Macon, Fort. N. C	6. 05	+0.29	3.08	-0.09	5. 38			-1.54		+8
Smithville, N. C. Wilmington, N. C. Charleston, S. C.	3.96	-0.32	2.94	-1.24	3.96	-1.78	3. 32	-1.41	3.06	+8.0
Wilmington, N. C	4.03	+1.15	3.38	-0.86	4. 30	- 2. 25	3. 34	-0.29	4. 43	+4.
Charleston, S. C	4. 12 4. 69	+2.76 +2.86	3. 69 3. 93	-0.05 -0.69	4. 28 5. 48	-2. 52 -3. 63	4. 67	-8.50 -2.65	4. 36 3. 32	-2: +2:
Augusta, Ga. Savannah, Ga. Jacksonville, Fla.	3. 64	+2.81	3. 13	-0.02	4. 05	-0.94	4.54	-8.40	2.96	+1.
Jacksonville, Fia	3. 66	+2.81 +3.52	3. 50	+1.73	3. 27	+2.39	3. 30	-2.06	4. 20	+3.
orida Paningul <b>a</b>										-
Cedar Keys, Fla	5. 21 2. 40	-0.24 +1.69	3.75 1.98	+5.27	3. 27 0. 66	-0.20 +0.33	2.50 1.83	-2.35 -0.86	2. 72 8. 98	+1.
Sanford, Fla	1.80	-1.20	2,79	+2.09 +1.17	2. 35	+2.25	3. 95	-2.43	8.01	-1. +1.
				,		,	5.50			T
Atlanta, Ga	7. 34	+1.10	5. 73	-1.59	6.74	-2.48	5. 18	-8.87	3. 20	+2.1
Pensacola, Fla	5. 59 5. 41	+2.53 +6.54	4. 27	-1. 07 -1. 62	4.40 7.77	+0.14	5. 08 5. 97	+0.41	4. 38	-2.
Montgomery Ala	4. 98	+4.74	5. 35	-1.67	6. 48	-3.55	6. 27	- 0.78 -2.35	4.85 4.11	-1.4 +4.4
Vicksburg, Miss	5. 65	+2.04 +3.98	5, 22	-1. 29	6. 59	-4.57	7.06	+1.94	5. 69	-0.6
Mobile, Ala Montgomery, Ala Vicksburg, Miss New Orleans, La.	5.72	+3.98	4. 15	-1.76	6.00	+0.99	6. 17	-2.50	5. 54	+0.
estern Gulf States: Shreveport, La			5, 07	1.50	4. 79	_3, 00	6.08			
Fort Smith, Ark	3. 28 2. 02	+6.83 -0.03		-1.76 -4.32	1.72	-0.04	4. 86	+0.99 +2.77	5. 12 8. 98	-l.
Little Rock Ark	4 70	-0. 29	7. 62		4. 83	-0.99	6. 24	-0, 21	6.44	-3.
Galveston, Tex	4. 11	+2.86	2.86	-0.82	3. 14		8. 30	+0.82	4. 58	+1.
Indianola, Tex	2.30	+4.10	1.82	0. 13	2. 55	-0.60	1. 81 4. 85	+3.38	8. 49	+1.3
Galveston, Tex Indianola, Tex Palestine, Tex San Antonio, Tex	4. 62 1. 34	+3. 15	3. 30 1. 83	-0.28	3. 40 2. 39	-1.15 +1.48	3. 15	+0.29	8. 44 8. 83	-2.8 +4.6
io terando vallove	1	`'	2. 50				J. 10		~~~	77.
Brownsville, Tex Rio Grande City, Tex	2.18	+1.69	1.77	+0.75	1. 25		0. 65	+0.02	3.43	+3.7
Rio Grande City, Tex	1. 21	+1.15	3.07	<b>∔0.05</b>	1.04	-0, 63	1.06	+1.44	3, 59	+6.6
hio Valley and Tonnessee:	9 01		5 30	1 00	R 95	_ 46	E 94	-3.64	3, 78	
Chattanooga, Tonn Knoxville, Tonn Memphis, Tenn	6.06	+U. 58	5. 01	-1.08 -2.04	5.74	-2.64	5. 52	-3. 59 -3. 39	3.78	+1.3
Manual to Manual to the second	2.00	0.00	5 10	2 00	E 00	9 00	6 30	2 20	4.74	<u>_1.6</u>

¹ Station closed December 31, 1885.

²Station closed October 31, 1885.

⁸ No record.

### APPENDIX 41.

the Signal Service, United States Army, for each month of the year.

ment of observations to December, 1885, inclusive.

Ju	ne.	Ju	ly.	Aug	gust.	Septe	mber.	Octo	ber.	Nove	mber.	Dece	mber.
Normal.	Departure +or	Normal.	Departure +or	Normal.	Departure +or	Normal.	Departure +or	Normal.	Departure +or-	Normal.	Departure +or	Normal.	Departure +or
In. 4. 14 3. 52 9. 61 3. 66 4. 36 3. 21 3. 48	In. +0.50 +0.54 +1.73 +0.04 -2.46 -1.78 -1.36	In. 4. 88 3. 83 10. 94 3. 76 3. 23 4. 76 4. 41	In. -2.89 +1.80 +0.40 -2.32 -2.37 -2.25 -1.74	In. 3, 34 3, 55 8, 10 4, 59 3, 42 5, 81 5, 35	In. +0. 92 +2. 36 +6. 16 +3. 05 -0. 27 +2. 32 +2. 34	In. 3. 64 2. 87 8. 67 2. 98 3. 10 3. 68 3. 25	In. = 0,00 -1.50 -3.11 -1.28 -1.50 -2.91 -1.81	In. 4. 67 3. 61 7. 60 4. 28 5. 14 3. 86 4. 30	In. +1. 29 +0. 71 +3. 51 +1. 43 +0. 67 +1. 51 +1. 86	In. 4.73 3.72 6.63 5.10 4.44 3.96 4.22	In. +0.05 -0.29 +0.04 +0.68 +0.35 -0.47 +1.47	In. 4. 00 3. 13 5. 37 3. 53 4. 62 5. 73 3. 54	In. +1. 90 -0. 10 -0. 50 -1. 40 +0. 00 -2. 42 +0. 38
3, 91 3, 28 3, 38 3, 18 3, 52 3, 52 4, 12 4, 00 4, 35 3, 63 2, 84 3, 45 4, 20	-1: 93 -1: 42 -2: 64 -1: 85 -2: 80 -1: 29 -2: 71 +2: 31 -1: 05 -1: 37 -1: 02 -0: 15 -0: 78	4. 32 4. 48 4. 24 3. 26 3. 26 4. 31 4. 32 4. 23 5. 89 3. 14 5. 36	-2. 34 -1. 44 -1. 85 +1. 19 -1. 96 -1. 69 -0. 77 -1. 65 -1. 20 -3. 00 -0. 61 +1. 12 -2. 14	3. 70 5. 09 5. 11 5. 07 4. 97 5. 58 4. 77 4. 50 4. 81 4. 94 3. 95 3. 97 5. 65	$\begin{array}{c} +3.88 \\ +2.61 \\ +1.69 \\ -0.57 \\ +1.17 \\ -2.11 \\ +0.71 \\ +3.28 \\ +1.68 \\ -2.07 \\ -2.01 \\ -2.41 \\ -3.26 \end{array}$	3, 36 3, 44 3, 32 3, 34 4, 75 3, 94 4, 36 3, 85 3, 98 4, 99 2, 61 3, 32 4, 76	-1. 36 -2. 72 -2. 15 -1. 75 -3. 37 -3. 13 -3. 78 -2. 55 -1. 89 -2. 66 +0. 52 -1. 94 -1. 45	3. 29 3. 32 2. 89 2. 82 3. 46 3. 35 3. 41 3. 10 3. 29 3. 81 2. 92 3. 24 3. 69	$\begin{array}{c} +2.25 \\ +2.30 \\ +0.44 \\ +0.12 \\ +0.04 \\ -0.36 \\ -0.09 \\ +3.41 \\ +5.40 \\ -1.32 \\ -1.32 \\ -1.32 \\ -0.36 \end{array}$	2. 68 3. 46 3. 21 3. 72 4. 28 3. 63 4. 14 3. 11 2: 91 4. 12 3. 57 3. 31 3. 46	+1. 22 +1. 59 +0. 14 +3. 12 +0. 61 (2) +0. 69 +0. 93 +0. 42 +0. 12 +2. 69 -0. 48 +1. 18	2, 65 3, 18 2, 61 4, 24 4, 34 3, 91 3, 13 3, 02 4, 32 4, 09 3, 86 3, 84	-1. 14 -0. 40 +0. 20 -3. 63 (3) +0. 42 -0. 56 -0. 33 -0. 85 +0. 07 +0. 10
4. 11 4. 70 4. 65 5. 51 3. 28 6. 22 5. 32 4. 06 7. 00 5. 75	-0. 63 -0. 28 -0. 84 +0. 30 -0. 93 +1. 99 +0. 64 -1. 26 +1. 11 +3. 23	5, 85 6, 38 6, 62 6, 41 5, 88 6, 22 7, 36 4, 38 5, 06 5, 38	+0.46 -2.58 -5.68 -1.10 -3.57 -2.18 +0.13 -0.69 +2.82 +1.78	4. 58 6. 21 7. 49 6. 48 5. 55 7. 91 8. 15 4. 74 8. 12 7. 08	$\begin{array}{c} -0.57 \\ -0.24 \\ -4.06 \\ +1.25 \\ +0.37 \\ -2.04 \\ +11.03 \\ -1.36 \\ +6.26 \\ +0.48 \end{array}$	3, 26 7, 34 5, 95 7, 25 6, 51 7, 64 6, 54 3, 90 5, 69 7, 99	$\begin{array}{c} +0.19 \\ -0.07 \\ -1.33 \\ -0.94 \\ +0.43 \\ -1.95 \\ -3.22 \\ -1.12 \\ +6.31 \\ +11.64 \end{array}$	3, 66 6, 99 4, 44 3, 75 5, 45 4, 09 4, 90 2, 26 3, 96 6, 22	$\begin{array}{c} +2.98 \\ +3.29 \\ +0.59 \\ +1.76 \\ +1.73 \\ +4.64 \\ +3.19 \\ +1.80 \\ +3.71 \\ -2.86 \end{array}$	4. 06 6. 06 5. 20 2. 96 3. 14 2. 75 3. 27 3. 93 2. 41 2. 95	+0.04 -2.41 -0.65 +0.62 +1.19 -0.08 -1.33 -2.38 -1.80 -2.45	5. 18 6. 40 5. 37 4. 70 3. 51 3. 66 3. 79 3. 83 3. 55 3. 29	$\begin{array}{c} -0.47 \\ -0.17 \\ +1.22 \\ +1.26 \\ \pm 0.00 \\ +0.17 \\ +2.51 \\ -1.60 \\ +1.96 \\ +4.47 \end{array}$
6, 95 4, 06 8, 01	+4.03 -0.48 -2.12	8. 60 4. 07 4. 74	+0.57 -0.92 +0.78	9. 57 5. 07 8. 19	+0.52 -2.52 -1.44	5, 56 6, 51 6, 00	+0.20 -1.28 +4.73	3. 52 5. 64 6. 29	+0.86 -0.57 +1.19	2.61 2.38 0.70	-1.44 -1.95 -0.41	3, 30 1, 82 1, 50	+0.54 -0.10 +0.35
4, 33 5, 37 5, 52 4, 75 3, 73 6, 02	+0,50 -1,39 -1,34 -0,43 -0,83 -2,72	3, 37 5, 75 6, 21 3, 95 4, 32 6, 57	+0.65 -3,34 -2,40 +3.59 +2.29 -0.42	4. 29 10. 69 7. 02 3. 40 3. 26 5. 53	+2, 63 +1, 05 -0, 95 +0, 53 -2, 22 -1, 28	3. 27 6. 52 5. 31 2. 93 4. 48 4. 91	+3, 24 -1, 02 +3, 94 +1, 90 +4, 80 +8, 64	2. 65 3. 96 3. 67 2. 58 3. 36 3. 37	+1. 29 -1. 58 -2. 48 -0. 20 -2. 35 -2. 81	4. 59 5. 44 4. 66 3. 56 5. 62 5. 28	-0.61 $+5.63$ $+0.17$ $+0.03$ $-2.43$ $-1.81$	5, 60 5, 27 4, 75 5, 25 5, 67 5, 02	-2.96 $-0.55$ $+0.25$ $-2.12$ $-2.81$ $-0.64$
3. 40 3. 38 3. 50 4. 19 2. 56 2. 97 1. 95	+2.39 +1.50 +0.09 -0.91 -2.35 -0.90 -1.09	4. 01 3. 62 3. 32 3. 51 2. 38 2. 62 3. 75	+0.88 -1.14 -2.19 -1.31 -0.30 (3) +2.81	1. 93 2. 34 3. 58 5. 11 3. 88 2. 04 3. 28	-1. 01 +0. 65 -1. 63 -3. 37 -3. 21 -0. 17 -2. 33	4. 39 3. 54 3. 00 7. 56 7. 01 3. 22 4. 54	+2.31 -2.55 -0.94 +18.45 +3.35 +1.41 -3.03	3. 72 3. 98 3. 10 5. 51 3. 71 4. 34 2. 48	+0.60 -1.67 -2.07 -3.31 -2.98 -2.87 -1.83	4, 87 3, 32 4, 58 5, 01 3, 07 5, 53 1, 76	-0. 94 -2. 20 -1. 94 -2. 69 -0. 42 -2. 05 -1. 06	5. 33 3. 10 4. 96 4. 77 3. 08 3. 55 2, 01	-1, 22 -1, 84 -1, 22 -2, 67 -1, 71 -0, 41 -0, 23
1. 72 1. 20	-1.18 -1.20	2.15 1.54	_1.93 _0.26	4.59 4.05	-2, 53 -3, 08	5.62 3,30	-2.07 +1.94	5.05 2.37	$^{+3.24}_{-0.52}$	2.30 0.77	-2.10 $-0.65$	2. 12 1. 26	_0.02 _0.87
4. 54 4. 37 5. 07	+1.55 -1.22 -3.55	3. 80 4. 55 2. 97	+1.06 $-0.55$ $+1.83$	4. 23 4. 24 3. 05	-0.17 -0.19 -1.35	4.13 2.87 3.05	+2,35 -0,66 +1,37	3, 52 3, 27 3, 58	+1.51 +4.59 -2.40	4. 86 4. 31 4. 43	+1.32 +1.84 -1.17	5, 63 4, 47 3, 99	-2. 22 -0. 02 -1. 07

28 sig

No record.

## Normal precipitation, and departure of 1885 therefrom, at stations of the

	Jan	uary.	Feb	ruary.	M	arch.	A	pril.	¥	lay.
Districts and stations.	Normal.	Departure +or—,	Normal.	Departure +or	Normal.	Departure + or	Normal.	Departure +or	Normal.	Departure +or
	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.
Ohio Valley and Tennessee—Cont'd: Nashville, Tenn	5. 24	+1.05	5. 31	-3. 31	5. 25	-2.92	5. 53	<b>—1.</b> 78	2.65	+0.71
Louisville, Ky	4. 23 3. 26	+2.11	4.71	-1.83	4.13	-3.11 ±0.00	4.60	+0.84 ±0.00	8.94	+0.25 ±0.00
Indianapolis, Ind	2. 83		3. 62	±0.00	3. 91	<b>—3.09</b>	3.57	+1.71	4. 25	-0.50
Cincinnati, Ohio	3. 60	+2.20 +0.57	3. 99 3. 86		3. 64 3. 18	-3.08 -2.65	3. 23 3. 21	+0.11	8. 55 4. 70	-L 48 +L 13
Pitteburg, Pa	3.09	+0.94	2.50				2. 50	∔0.29	2.78	+0.48
Lower Lakes: Buffalo, N. Y. Oswego, N. Y. Rochester, N. Y.	2. 69	+0.41	2 47	<b>—0. 90</b>	2.88	-1.35	2.43	+1.04	8.04	+0.76
Oswego, N. Y	3. 09 3. 33	-1.07 -1.23	2.49	-1.27 -1.01	3.05 3.24	-2.57 -2.28	1. 99 2. 55	-0.13 +0.41	2.82 3.15	+0.55 -1.13
Erio. Pa		→0.15	2. 55 3. 26	-1. 16	3.08	-1.25	2.50	0. 25	8. 67	+1.23
Cleveland, Ohlo	2. 45 2. 21 2. 16	+0.18 +1.08	2. 69 3. 14	-2.81	2.68	1, 93	2, 52	+0.07	3. 25 3. 54	+0.63
Toledo, Ohio	2. 16 2. 12	+0.96 -0.23	1. 92	-1. 31	2. 15	-1.52	2, 28	+0.13 -0.45	2. 23 2. 63	+1.78
Upper Lakos: Alpens, Mich Escanaba, Mich Grand Haven, Mich Mackinaw City, Mich Marquette, Mich Port fluron, Mich Chicago, Ill Milwaukce, Wis Duluth, Minn	2.12 1.28	-0.03; +0.06	2. 11 1. 37	-0.48 -0.44	1.97 1.74	-0.72 +0.49 -1.48	1.85 1.93	+0.43 +1.23	8, 90 8, 90	-1.63 -0.29
Grand Haven, Mich	2.38	+0.82	2. 10	-0.44 -0.53 -0.80	2, 50	-1.48 -0.10	2.62 1.19	-L 24	3. 42 2. 90	-2.25 -0.37
Marquette, Mich	1. 27	+1.50	1.40	+0.90	1.40	+0.74	1.72	+0.24	3, 00	+0.19
Port Huron, Mich	2.01	+0.86	2.49	+0.90	3. 57 2. 80	-2. 86 -2. 23	2. 16 3. 63	-0.90 +0.87	8. 11 8. 81	+0.69
Milwaukee, Wis	1.00	-0.80	1.87	-0.31 -1.38	2. 05	-2, 44 -0, 82	2.96	-0.64	8. 43 3. 86	-3,02
Duluth, Minn Upper Mississippi Valley:	0.98	-0. 37		1	- 1		1	-1.19		<b>2.3</b> 3
Upper Mississippi Valley: Saint Paul, Minn La Crosse, Wis Davenport, Iowa	0.98	-0.68 -0.69	1. 02 1. 12	-0.82	1.55	-1.00	2. 16 2. 03 3. 03	+1.03 -0.18	3. 51 8. 36	-1.39 -0.84
Davenport, Iowa	1.70	+0.40	1 53	-0.84 -0.35 -1.12	2. 20	-1. 19 -2. 03	8.03	-0.56	4.28	-2.84
Des Moines, Iowa Dubuque, Iowa Keokuk, Iowa	1.02	0.02 0.34	1.51	-1.12 -0.80	1.33 2.28	-1. 29 -1. 87	2.78 2.97	+0.72	5. 53 8. 90	-3.83 -1.28
Kookuk, Iowa	1.66	+0.78	1.71	-0. 80 -0. 57 -2. 86	2. 22	-2. 05 -2. 89	3.12	+0.21	4.07	-1.48 -1.06
Cairo, Ill Springfield, Ill Saint Louis, Mo.	4. 19 2. 05	-0.70 +0.76	4. 34 4. 90	3. 96	2. 83	2, 66	4.11 3.72	+2.64	5. 40	-2.62
Saint Louis, Mo	2. 17	+1.09	3. 04	<b>—2.</b> 17	2. 86	-2.46	8. 50	+1.34	8.71	-0.91
Leavenworth Kans	1. 33	+0.14		-0.66	2.34	-2.03 -1.17 -0.88 -0.60	8. 87	+2.76	5. 11 4. 98	+0.78
Omaha, Nebr	0.55 0.73	-0.14 -0.59	0. 83 0. 64	-0.36 -0.43	1.01	-0.88	3. 55 2. 20	-0.36	2.58	-0.55 -0.18
Huron, Dak	0.14	+0.01 -0.20	0. 38 0. 31	-0.16	0.72	-0.60 -0.85	2. 52 1. 59	+2.79 -0.36 -1.46 +0.79	4. 26 2. 78	+0.94
Sully, Fort, Dak Yankton, Dak	0. 57	-0.01	0.81	-0.41	1. 12	-0.87	3. 26	+1.82	4.54	<b>—</b> 0.53
Extreme Northwest: Moorhead, Minn		<b>—0.72</b>	1.01	<b>—</b> 0. <b>9</b> 3	1.03	-0.72	1.75	+1.68	8. 15	-0.88
Saint Vincent, Minn	0. 33	-0.01	0.39	-0. 29	0.54	-0.08 -0.88	1. 22	+1.63 +0.83	2.35 3.03	-0.76 -2.10
Bismarck, Dak Buford, Fort, Dak	0.54	-0.09	0. 65 0. <b>49</b>	-0.05		-0.42	1.84	+0.37	2.01	0.99
Totten, Fort, Dak Northern Slope:	0.22	0. 05	0.42	-0. 17	0.42	<b>0. 27</b>	2.72	+0.35	1.45	+0.25
Assinaboing Fort, Mont	1. 19		0.58	+0.20	0.61	-0.51	0.79	-0.41	1.28 2.60	-0.85 -2.12
Benton, Fort, Mont	0. 82 1. 12	+0.12 -1.04	0. 51 0. 44	+0.09 -0.28	0.48	0. 83 0. 24	1.06	-0.20 -0.55 -0.22	2.75	-2.28
TT-1 Mana	1 1 01	A 40	0.75	+0.07 +0.27	0. <b>8</b> 8 0. <b>9</b> 1	-0. 10 -0. 21	1.22	-0.22	1.07	-0.22 -0.54
Poplar River, Mont	0.53	+0.28	0.49	+0.15	0.37	0.85	0.77	±0.00	1.48	-0.71
Shaw, Fort, Mont Deadwood Dak	1.31	+0.56 +0.59	1.19	.i.1.69	0. 52 1. 97	+1.84	4, 81	-0.09 -1.70	5. 16	-0.71 -1.94
Maginnis, Fort, Mout Poplar River, Mont Shaw, Fort, Mont Deadwood, Dak Cheyenne, Wyo North Platte, Nobr	0. 27	-0.11	0. 22	+1. 39 -0. 21	0. 56 0. 61	-0.05	1.24	+2.52 -0.23	2. 26 3. 11	
Middle Slope:		-0.44							1	•
Denver, Colo			0.45 1.50	+0.27	0.87	+0.10	2.06 3.50	+2.88 +1.89 -0.40 +0.14	8. 10 4. 19	-0.97 +1.99
West Las Animas, Colo	0. 21	+0.01	0.31	<b>—0.02</b>	0.45	-0.00	0.85	-0.40	2.88	-2.89 -0.23
Dodge City, Kans Elliott, Fort, Tex	0.28	+0.24 +0.14	0. 34	-0.07 +0.43	0. 53	-0.06 +1.33	1.44	+3.23	5. 88	+1.35
			4		4.00	E 4. VV	- 70			
Concho, Fort, Tex.3	1.14	+0.16	1.14	0.73	1.30	+0.44	2. 22	+1.94	4. 22	-1.53
Southern Stope: Sill, Fort, Ind. T Concho, Fort, Tex. Davis, Fort, Tex. Stockton, Fort, Tex	1. 14 0. 63 0. 21	+0.16 +0.06 +0.18	1.14 0.19 0.81	-0.73 +0.09 +0.07	1.30 0.41 1.38	+0.44 +0.87 +6.40	0.58 0.45	+1.94 -0.12 +0.28	1.59 1.51	+0.38

Signal Service, United States Army, for each month of the year-Continued.

·Jt	ine.	Jt	ıly.	Au	gust.	Septe	mbor.	Oct	ober.	Nove	omber.	Dece	mber.
Normal.	Departure + or	Normal.	Departure +or	Normal.	Departure + or	Normal.	Departure +or	Normal.	Departure + or	Normal.	Departure +or	Normal.	Departure +or
In.	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.
4. 17	-0.45	5. 02	+0.24	3. 26	-2.24	3. 49	+2.11	3. 01	-0.02	3. 82	-1.09	3. 78	-0, 88
4. 39	-1.21	4. 22	-2.21	3. 51	-0.54	2. 98	+2.73	3. 50	+1.47	3. 76	+2.41	4. 41	-1, 57
8. 64	±0.00	4. 22	±0.00	7. 24	±0.00	6. 01	+0.00	2. 47	+1.20	2. 14	+0.40	5. 31	-1, 43
5. 47	+0.27	5. 51	-4.08	3. 29	+2.53	2. 68	-0.82	3. 37	-0.12	3. 65	-0.94	3. 45	-1, 00
4. 74	-0.76	8. 92	-2.52	4. 08	+0.87	2. 32	+0.40	2. 94	-0.64	3. 25	-0.92	3. 83	-2, 01
3. 99	+1.09	3. 66	-0.38	3. 87	+2.03	2. 52	+0.32	3. 47	-0.36	3. 31	-0.23	3. 56	-1, 71
3. 51	-0.83	4. 63	-2.16	3. 32	+2.32	2. 59	-0.90	2. 66	+1.63	2. 45	+0.12	2. 93	-1, 29
3. 37 3. 38 3. 32 4. 17 4. 45 4. 90 3. 68 3. 78	+3.02 +0.56 +0.95 +2.67 +2.77 +1.71 -0.32 -0.42	3. 67 3. 38 3. 42 3. 36 4. 29 4. 16 3. 68 4. 03	-0.04 +1.51 -0.68 -1.33 +0.19 -1.08 -1.19 -1.20	3. 43 2. 44 2. 95 3. 40 3. 41 4. 03 2. 94 2. 98	+7. 20 -0. 07 -0. 75 +4. 57 +1. 73 -0. 16 +0. 66 +2. 07	3. 16 2. 56 2. 34 4. 25 8. 77 3. 31 2. 44 2. 60	+1. 72 +1. 06 +0. 15 -0. 83 -1. 76 -1. 49 -0. 27 -1. 06	3. 96 3. 46 3. 21 4. 55 3. 10 3. 18 2. 81 2. 73	+2. 23 -0. 13 -0. 55 +3. 62 +0. 68 -0. 26 -0. 89 -1. 05	3. 43 3. 19 2. 76 4. 57 2. 69 3. 28 2. 88 2. 48	-0.77 -1.02 -2.66 +1.26 +1.98 -0.53 +0.22 -0.29	3. 46 3. 67 2. 00 3. 42 2. 60 2. 78 2. 51 2. 77	+1.05 +0.20 -0.74 -0.23 -1.01 +0.38 -0.47
3. 86	-2. 12	3. 46	-0.04	8. 73	+3. 45	4. 50	-0.83	4.66	-0. 26	2. 86	-0. 30	2. 39	+0.73
4. 60	-2. 66	3. 86	-1.22	4. 18	+1. 07	4. 21	-2.52	3.87	-1. 52	2. 68	+0. 73	1. 83	+1.54
4. 62	+1. 02	8. 39	-0.20	3. 00	+1. 82	3. 97	+0.74	4.04	+0. 11	3. 18	-1. 55	2. 63	+0.77
2. 58	-0. 70	3. 47	+0.08	2. 67	+0. 11	1. 81	-1.12	2.91	-0. 87	3. 03	-0. 82	4. 05	-2.32
4. 08	-0. 74	3. 25	-1.40	3. 10	-0. 03	4. 95	-3.95	3.77	-0. 86	2. 45	+1. 65	2. 08	-0.21
4. 01	+1. 28	2. 94	+0.06	2. 82	+0. 40	2. 45	-0.39	3.17	-0. 65	2. 70	+0. 40	2. 43	+0.10
4. 35	+0. 85	3. 84	-1.40	8. 23	+8. 05	2. 79	+0.18	3.84	+0. 03	2. 84	-0. 51	2. 30	+1.05
4. 23	+2. 26	3. 45	+0.78	8. 00	+4. 30	8. 14	+0.16	2.77	-0. 37	2. 09	-0. 56	1. 80	+0.82
5. 33	-0. 51	4. 06	-0.60	3. 49	-0. 98	4. 43	-2.08	2.98	-2. 19	1. 73	-0. 36	1. 33	-0.79
4. 94	-1.21	3. 38	+2.48	3. 76	-0.07	3. 36	+0.16	2. 14	-1. 21	1. 32	-0. 72	1. 20	-0.65
4. 75	+0.17	g. 29	+3.22	3. 65	±0.00	5. 09	-0.31	2. 58	-2. 28	1. 89	-1. 29	1. 33	+0.04
4. 80	-2.72	3. 78	-2.12	4. 21	+8.47	3. 35	+0.84	3. 09	-0. 88	2. 05	-0. 85	1. 70	+0.25
7. 91	-2.88	4. 36	+2.19	3. 89	+1.22	3. 39	+1.43	4. 65	-0. 47	2. 35	-1. 74	1. 59	+0.37
5. 69	+0.47	5. 38	+0.97	3. 84	+4.18	4. 87	-0.29	3. 14	-0. 82	2. 20	-1. 66	1. 90	+1.24
5. 61	-1.36	4. 51	-2.22	3. 08	+2.90	3. 65	+0.12	3. 56	+0. 03	2. 01	-1. 13	2. 25	-0.29
4. 53	+0.10	4. 04	-3.22	2. 76	-0.36	2. 72	+2.04	3. 29	-0. 40	3. 94	-1. 15	8. 68	-0.67
6. 49	-2.21	2. 54	-0.72	2. 87	+1.95	3. 43	+1.04	4. 60	+1. 70	3. 21	-1. 77	3. 26	-0.74
4. 99	-2.69	4. 14	-1.56	2. 50	+0.46	3. 21	+5.77	3. 07	+4. 44	2. 63	-0. 95	2. 42	-0.39
5, 59	-1.59	5. 08	-0. <b>5</b> 2	3. 43	+1.77	3.55	+4.10	3. 42	+0.81	2. 44	-0.58	1. 67	-0.70
6, 46	-3.79	6. 17	+3. 07	3. 59	+0.94	8.53	-1.03	3. 15	+0.71	1. 32	-0.59	1. 01	+0.16
8, 97	+1.65	2. 17	-0. 62	2. 21	+3.66	1.24	+0.23	0. 69	-0.55	0. 29	-0.01	0. 45	(¹)
4, 70	+0.73	4. 86	-0. 34	2. 92	+0.97	1.90	+0.71	1. 90	-1.01	0. 56	+0.94	0. 32	-0.22
3, 56	+1.56	2. 50	+9. 21	2. 02	+2.48	1.19	+0.58	0. 70	-0.58	0. 43	+0.22	0. 46	-0.32
4, 94	-2.04	3. 98	-2. 01	2. 87	+3.34	2.89	+1.91	1. 76	-0.52	0. 53	+2.16	0. 70	-0.63
4. 62	+3.30	4. 42	-1.08	3. 84	-2.37	2. 61	-0. 44	2. 88	-2, 20	1. 02	-0.38	0. 82	-0.50
2. 68	+0.24	2. 74	+1.08	3. 13	-2.18	1. 95	-0. 97	2. 43	-2, 50	0. 56	+0.56	0. 56	-0.02
3. 53	-1.14	2. 36	+0.05	2. 71	-1.09	1. 32	-1. 18	1. 23	-0, 69	0. 71	-0.05	0. 77	-0.43
3. 16	+2.89	2. 56	+0.46	1. 19	+0.31	0. 78	-0. 52	0. 84	-0, 65	0. 39	+0.17	0. 86	-0.72
2. 98	+0.47	4. 44	+1.39	2. 82	-0.91	0. 72	-0. 59	0. 79	-0, 13	0. 58	+0.32	0. 48	-0.01
2. 18 2. 23 2. 79 2. 61 2. 19 1. 84 4. 20 1. 51 8. 73	(1) +3.87 +1.39 +1.85 +2.22 +2.67 +0.49 +0.63 +1.24 +0.06	3. 26 1. 90 1. 15 1. 32 0. 60 1. 80 1. 67 2. 35 1. 72 2. 97	-1.70 +0.92 -0.30 -0.16 +0.28 +1.25 +0.90 -0.91 +0.19 +0.15	1. 90 1. 12 1. 23 0. 85 0. 81 0. 72 0. 99 2. 09 1. 51 2. 52	-0.45 +0.69 +0.37; -0.37 +0.13 -0.30 +0.36 -0.83 +0.63 +2.35	1. 28 1. 02 0. 74 1. 51 0. 70 0. 64 1. 52 0. 81 0. 88 1. 35	-1. 11 -0. 77 -0. 06 -1. 40 +0. 43 -0. 49 -1. 27 +0. 09 -0. 19 -0. 49	0. 55 0. 79 0. 24 1. 00 1. 45 0. 89 1. 02 1. 57 0. 72 1. 32	-0. 49 -0. 42 +0. 64 -0. 84 -0. 82 -0. 80 -0. 06 +0. 12 -0. 44 -0. 14	0. 95 0. 78 0. 24 0. 59 0. 62 0. 32 0. 58 1. 11 0. 31 6. 44	-0. 79 -0. 13 +0. 22 -0. 44 +0. 05 -0. 03 -0. 55 +0. 29 +0. 80 +1. 27	0. 74 0. 64 0. 09 1. 38 0. 80 0. 31 0. 81 1. 50 0. 21 0. 77	-0. 83 -0. 26 +0. 83 -1. 17 +0. 14 +0. 10 -0. 04 -0. 32 -0. 05 +0. 18
1. 52	-0.86	1.76	-0.43	1.53	-0.35	0, 92	+0.30	0. 74	-0.01	0. 69	-0. 14	0. 74	+0.34
1. 79	-0.50	4.38	-1.71	3.98	-1.94	1, 86	-0.82	1. 49	+0.04	1. 86	-0. 99	1. 48	+2.55
2. 51	-0.37	1.70	+1.01	2.12	+1.63	0, 60	+0.39	0. 64	+0.55	0. 31	+0. 39	0. 83	+0.06
2. 97	-0.95	3.63	+2.40	3.30	-1.50	1, 29	+2.19	1. 32	-0.26	0. 63	-0. 27	0. 80	+0.96
4. 08	+5.74	3.14	+0.48	3.47	+1.47	2, 23	-1.58	2. 81	-2.21	0. 65	-0. 40	1. 02	+1.09
5. 42	+2.74	3. 03	—1. 64	2. 74	+2.98	2. 73	+0.10 (1) -0.50 -4.02	2. 37	—1. 39	1. 94	-0. 66	2. 13	-0.55
2. 67	+1.88	3. 47	—1. 88	3. 55	-1.64	4. 36		2. 99	(¹)	1. 31	(¹)	1. 47	(¹)
2. 24	-1.07	8. 58	—1. 08	5. 27	-1.93	2. 08		2. 14	—1. 44	0. 45	-0. 44	0. 39	-0.15
2. 15	+0.71	1. 99	—0. 63	2. 52	-1.91	5. 24		1. 56	—0. 44	0. 70	-0. 56	0. 70	(¹)

¹ No record.

Station closed September 15, 1885.

### Normal precipitation, and departure of 1885 therefrom, at stations of the

	Jan	u <b>ary</b> .	Feb	ruary.	M	arch.	A	pril.	¥	iay.
Districts and stations.	Normal.	Departure + or—.	Normal.	Departure + or—	Normal.	Departure +or—	Normal.	Departure +or	Normal.	Departure +or-
Southern Plateau:	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.
Santa Fé, N. Mex El Paso, Tex Apache, Fort, Aris Grant, Fort, Ariz Prescott, Ariz Thomas, Fort, Ariz Yuma, Ariz Middle Plateau:	1.18	-0.50 -0.66 -0.41 -0.90 -0.88	0. 45 1. 86 1. 26 1. 35 1. 82	-0.42 -0.86 -0.24 -0.89 -0.32	0.52 1.84 1.42 1.42 1.44	-0, 18 +0, 21 -0, 02 +0, 05 -0, 69	0. 21 0. 78 0. 22 0. 89 0. 26	-0.17 -0.26 -0.18 -0.37	0.46 0.65 0.41 0.54 0.34	+0.81 +9.47 -0.16 -0.17 -0.25
Winnemucca, Nev Salt Lake City, Utah	1. 13 1. 84	-0.34 +0.14	1.02 1.89	+0.89 +0.17	0. 79 2. 06	-0.59 +0.58	1.02 2.53	-0.02 +0.94	6. 98 2. 17	+0.09
Northern Plateau: Boia6 City, Idaho Lewiston, Idaho ¹ Dayton, Wash ² Spokane Falls, Wash	2. 27 3. 64	-0.81 -0.60 -1.35 -0.22	2. 02 3. 99	+0.86 -0.25	1.07 1.66	-0.54 -1.61	1. 12 2. 58	0. 93 2. 52	1.33 1.99	+1.69
North Pacific Coast: Canby, Fort, Wash Olympia, Wash Tatoosh Island, Wash Portland, Oreg. Roseburg, Oreg	8, 48 13, 90 6, 88	-2. 25 +0. 57 -2. 31	9. 66 7. 78	-1.81 +3.62 -1.06	4.90 2.38 6.43	-4.40 -0.04 -5.80	8.76 1.84 3.32	-3, 37 -1, 47 -2, 20	2.61 4.96 2.52	+0.23 +0.50 +2.17
Middle Pacific Coast: Cape Mendocino, Cal. Red Bluff, Cal. Sacramento, Cal San Francisco, Cal	5. 55 8. 75	-0. 12 -3. 71 -1. 59 -2. 30	4.06 3.41	-2. 87 -2. 92	8. 10 8. 84	-3. 10 -3. 26	2.78 3.40	-2.16 -2.72	1.13 0. <b>69</b>	0, 49
South Pacific Coast: Los Angeles, Cal San Diego, Cal	2.06 1.71	-1.01 -1.36	3.76 2.42	3. 75 2. 40	3. 01 1. 34	-3.00 -0.56	2.00 0.87	+0.01 +0.33	0.51 0.42	-0.45 +0.19
Alaska Stations: Alexander, Fort Saint Michael's, Fort Sitka Unalashka Behring's Island, Behring Sea	3. 90 0. 91 10. 83 13. 48	-2.64 -0.53 -0.41 +16.89	0. 89 0. 17 9. 82 7. 68	-0.89 +0.14 +0.04 -3.26	8. 13 0. 46 10. <b>6</b> 6 6. 77	-0.68 +0.61 +1.43 +1.65	1.79 0.54 5.88 6.41	+1.62 +0.23 +7.54	4.72 4.64	+0.11 -1.17 -2.17

Station closed December 31, 1885.

² Station closed November 30, 1885.

Signal Service, United States Army, for each mouth of the year—Continued.

Jı	ine.	Jt	ıly.	Au	gust.	Septe	mber.	Oct	ober.	Nove	mber.	Dece	mber.
Normal.	Departure + or—	Normal.	Departure +or	Normal.	Departure + or—.	Normal.	Departure +or—.	Normal.	Departure +or	Normal.	Departure +or	Normal.	Departure +or
In.	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.
1. 18 0. 47 1. 00 0. 80 0. 16 0. 42 (3)	+0.39 +2.16 -0.18 -0.07 -0.09 -0.24	3. 22 8. 01 4. 05 8. 34 2. 17 1. 84 0. 18	-2.09 -1.95 -1.45 -2.41 +0.36 +1.09 -0.13	2. 84 2. 28 4. 74 3. 33 3. 08 2. 41 0. 32	-1.86 -1.82 -1.58 -1.75 -1.84 +0.05 +0.54	1.30 1.22 1.58 1.23 1.14 0.55 0.07	+0.57 -1.00 -1.14 -0.42 -1.03 -0.53 -0.07	1. 03 1. 44 1. 67 0. 93 0. 58 0. 30 0. 04	+0.04 -0.98 -1.29 -0.90 -0.29 -0.04	0. 92 0. 47 1. 06 0. 62 0. 89 0. 34 0. 18	+0.68 +1.77 +0.04	0.86 0.74 2.15 1.73 1.88 1.51 0.44	+1.41 -0.37 -0.74 -0.92 -1.56 -0.80 -0.43
1.00 0.84	+1.41 +1.83	0. 11 0. 59	-0.11 -0.01	0. 10 <b>0.</b> 85	0.06 +0.05	0. 35 0. 88	-0.27 +0.41	0. 55 1. 70	0.48 1.11	0.95 1.61		1. 23 1. 43	-0.23 -0.51
0, 96 2, 38 1, 28 1, 80	+0.12 +2.53 +0.92 +1.60	0. 20 0. 74 0. 58 0. 92	+0.03 -0.62 -0.57 -0.53	0. 09 0. 32 0. 35 0. 29	±0.00 +0.09 -0.28 -0.13	0. 57 0. 63 0. 87 1. 35	-0.18 +0.03 -0.28 -0.47	1.51 1.75 2.54 2.26	-0.93 -1.04 -1.81 -1.46	0. 88 1. 52 2. 19 2. 30	+0.61 +0.52	2. 21 3. 10 4. 98 2. 20	-1. 14 -0. 80 (*) -0. 45
2.74 1.16 2.88 1.79 1.08	+0.59 -0.87 -1.11 -0.02 +0.45	0.98 0.86 0.95 0.75 1.08	-0.76 +0.24 -0.78 -0.51 -1.01	0, 68 0, 75 2, 80 0, 72 0, 43	-0.56 -0.75 -2.68 -0.72 -0.43	4. 29 3. 07 7. 88 1. 87 0. 38	-0.86 +0.62 +1.72 +0.61 -0.02	5, 12 5, 15 6, 95 4, 65 2, 77	-1.64 -2.31 +0.56 -2.97 -1.11	7. 17	+2.55 +5.29 +1.85	11. 02 8. 15	+3.11 -3.47 -0.88 -0.98 +0.19
0. 75 0. 41 0. 29 0. 32	+0.57 +0.96 -0.18 -0.13	0. 26 0. 02 (4) 0. 01	+0.06 +0.03 ±0.00 +0.05	0. <b>2</b> 9 0. 03 ( ⁴ ) 0. 01	+0.53 -0.03 (4) -0.01	1. 10 0. 70 0. 30 0. 16	+0.40 +2.21 -0.22 -0.05	1.58 1.28 0.93 1.20	-0.47 -1.18 -0.91 -0.48	2.30	+13.20 +9.04	2.51 5.19 4.24 4.93	+0.20 -1.33 +1.52 +0.06
0. 19 0. 07	0. 19 0. 01	(4) 0. 02	±0.00 0.02	(4) 0. 20	±0.00 —0.07	0. 01 0. 05	+0.04 -0.05	0.56 0.47	-0.26 -0.16				-2.02 -1.51
1. 88 1. 36 3. 10 4. 26 1. 66	+0.83 +2.15 -0.74 -2.23 -0.03	4. 13 1. 75 5. 22 2. 78 2. 46	-0.70 +1.31 -1.37 +1.37 +1.59	4. 48 2. 61 5. 68 3. 40 2. 09	+4.51 +1.95 -1.68 -0.06 +0.06	4. 98 2. 90 10. 29 8. 64 2. 50	-0. 82 +0. 49 -1. 96 -1. 00 +0. 82		+0.28 +2.33	12.81 9.80	0. 89 2. 66 0. 55	0. 67 11. 48 11. 81	+0.16 +0.08 +0.22 -3.73 -0.01

² No record.

⁴ Inappreciable.

# APPENDIX 42.

Monthly and annual precipitation, from reports made by voluntary observers of the Signal Service, United States Army, for the year ending December 31, 1885.

		ا ننا			-		)		j.		<u> </u>	<u>;</u>	
Stations.	January	February	بغ					August.	September	October.	<b>Хоте</b> шbег	December	la!
Sustions.	ana	e l	March	pril	May.	June.	July.	gu.	pte	ctol	0 <b>r</b> e	ခ	A nnual.
	J	<u>F4</u>	7	4	<u> </u>	J	J	4	<u>v</u>	0	×	Α.	<u> </u>
	In.	In.	In.	In.	In.								
Accotink, Va	4.00 8.16	3. 70 3. 97	1. 22 2. 46	1.61 2.19	2. 34 8. 03	2.35 (¹)	1.78	3. 56	1.48 (¹)	6. 97	2.88 1.03	1.96 2.78	33. 85
Albany, Oreg	4. 20	5. 82	0. 81	1.38	3. 93	1. 95	(1)	0.00	2. 13	(¹) 1.75	8. 40	7. 04	
Albion, Idaho	0. 30		0. 19	0.30	2.34	1.02	(1)	(¹)	(1)	(1)	(1)	(1)	•=====
Allison, Kans	0.32 3.92	1. 14 1. 59	0. 68 0. 44	2. 22 1. 83	1.60 1.51	2.01 1.54	4. 01 2. 09	2.05 5.67	1.96 0.82	2.31 3.61	0. 52 1. 92	2. 12 1. 73	
Amherst (Agri. Sta.) Mass	3.78	3.88	0.86	3. 38	3.08	3.49	2.07	8.31	0.85	2.65	5. 54	3.54	42.43
Aiken, S. C. Albany, Oreg Albion, Idaho Allison, Kans Altoona, Pa Amherst (Agri. Sta.) Mass Anna. Ill	4. 21 4. 64	3.38 1.22	1. 25 1. 43	3. 49 2. 69	2. 25 2. 24	3. 10 6. 89		7. 62 4. 13	0. 67 4. 54	4. 12 3. 43		3. 90 2. 93	41. 44 38. 13
Anna III Ann Arbor, Mich Antrim, N. H Archer, Fla Ashland, N. H Asheville, N. C Ashwood, Tenn	2.54	1. 22		3. 47	8.72			4. 13 (1)	4. 04 (1)	(1)	(1)	(¹)	38. 13
Antrim, N. H	(¹)	(1)	(1)	8.30	2.90	3. 20	2.40	6,00	2.45	3.90	6. 50	4.35	
Archer, Fla	8. 18 5. 69		3.75 1.87	0. 27 2. 25	6. 63 1. 89	11.45 4.56		10. 23	11. 62 1. <b>6</b> 3	4. 77 8. 84	1.41 5.71	5. 61 5. 15	76.73 47 51
Asheville, N. C.	4. 20		(1)	1. 10	3. 90			(1)	(1)	8.30		(1)	6, 50
Ashwood, Tenn	5. 00			3, 60	3. 90	4. 10	8.60				8. 10	3, 77	42.71
Atchison, Kans	1. 27 7. 88	0. 91 4. 86	0. 25 8. 37	5.30 1.07	3. 10 7. 22	5. 20 4. 40		4. 05 7. 05				1. 10 2. 86	34. 87 61. 24
Auburn, N. Y	5. 78	8. 56	1. 33	2. 61	2.46	3. 10	4.64	6. 83		3. 95	2.38	2.78	42.46
Austin, Tenn	5. 87	2,06	1. 59		4.78	2. 93 0. 63	4. 51	(1)	(1)	3. 21		2.98	· • • • • • •
Rainbridge Island, Wash	5. 87 1. 01	(¹) 5. 40	2. 22 0. 77	4.71 0.25	(¹) 3. 35	0. 35	1.68 0.82	1. 66 0. 01	·(¹) 4. 27	2.82 4.40		2. 69 6. 22	34. 89
Bandon, Oreg	6. 82	12.42	(1)	0.97	2. 10	1.78	(1)	0.02	2. 32	2.45	18, 21	13. 27	
Belmont, N. H.	5.06 1.96	4.09 1.21	1.42 0.21	2.09 3.75	1. 93 1. 54	3. 40 5. 37	1. 54 2. 99	5. 95 9. 23	0. 97 4. 56	2. 39	4.70 (¹)	4. 46 (1)	38.00
Atchison, Kans Athens, Ga Anburn, N. Y Austin, Tenn Austin, Tex Bainbridge Island, Wash Bandon, Oreg Belmont, N. H Beloit, Wiss Bethel, Conn	5.06	3.61	1. 32	2.71	1.65	1.70		5. 80	0. 70	4.75	6, 50	2. 90	41.14
Dindle Most Wo	K 20	3.40	3.00	2.05	7. 85	1.50		7. 05	3, 00			3. 15	48.80
Birmingham, Ala Birmingham, Mich Blooming Grove, Pa Blue Hill, Mass	8	8	(¹) 0. 89	(¹) 2. 91	6. 48 3. 52	(¹) 3. 63	(¹) 4. 49	8	(¹) 2. 11	(1) 1.61	(1) 2.66	3.40 2.62	
Blooming Grove, Pa	1. 50	(1)	0.95	2. 22	2.00	1.60	2. 30	9. 20	1.06	7.70	3. 20	2. 10	
Blue Hill, Mass	(1) 8.79	1. 18 8. 39	0. 78 1. 45	2. 91 3. 30	4. 19 1. 34	2, 63 1, 57		6. 28 0. 00	1.88 0.93	5.92		2. <b>2</b> 0 13. 70	73, 11
Blue Lake, CalBoyne, Mich	/11	(1)	2. 32		4. 03			(1)	1.56	(1)		(1)	73.11
Boyne, Milon Brattleborough, Vt Bristol, N. H Bruington, Va Bunker Hill, Ill Burlington, Vt Cahuenga, Cal Carson City, Nev Carthage, Mo	(-)	(1)	(1)	3. 13	2. 92	2.46		6. 84	1.36	4.74	5. 64	2,75	•=====
Bristol, N. H	5.79 (1)	8. 54 (¹)	1.74 2.10	2. 16 2. 25	2.15 4.42	8. 01 3. 89		8. 58 5. 14	1.84 1.14	3, 65 4, 55		2.44 4.09	45. 21
Bunker Hill, Ill	3. 09	0.87	0.42	4.27	1.98	8. 22	2. 29	3.96	5.73	4.89	1.85	2.42	39.49
Burlington, Vt	2.36		0.86	2.53 2.19	2.48 0.10				3. 50 0. 00			2.07	33. 64
Cannenga, Cal	0.84 0.40	0.00 0.18		3.41	0. 07	0.46						1. 65 1. 75	12.41
Carthage, Mo	(1)	(1)	1.45	7.38	4.40	5. 36	4.31	4.30	(1)	1.90	0.84	1.64	
Catawissa, Pa	4. 13 2. 15		1.04 0.61	2. 43 7. 82	2. 68 5. 92	2. 22 3. 46		7.36	0.97 2.84	5, 65 2, 50		2.83 1.48	29.85
Catawissa, Fa Codar Rapids, Iowa Centreville, Mo Chambersburg, Pa Chapel Hill, N. C Charleston, Ill Charlotte, Vt	(1)	(4)	(¹)	(1)	(1)	10.73	5, 53	(1)	6. 26	1.71	2,73	2. 85	
Chambersburg, Pa	3.62	3.47 2.73	0. 91 3. 50	2.85 2.71	1. 20 4. 34	2.20	0.78 3.95	5. 64 (1)	0. 93			1.05	28. 30
Charleston, Ill	5. 24 (1)	0. 96	0. 12	4.74	3. 10			6, 47	(¹) 4.49	(¹) 3. 24	(¹) 2.61	(1) 3, 34	
Charlotte, Vt	(¹) 4. 30	2.70	0.50	2.50	2.80	5, 20	5.00		5.70	7. 20		2, 20	49. 20
Chester, Minn	(1) 4. 26	(¹) 2.45	0. 85 0. 70	1.88 3.32	1.79 2.99		8	9	(1) 3.06	(¹) 3. 05	(1) 2.57	(¹) 2.15	• • • • • •
Clay Centre, Kans	1.11	1. 19	0.38	5.96	4.74	3. 34	6.06	1.45	(1)	(1)	(1)	(1)	
Chester, Minn Cincinnati, Ohio Clay Centre, Kans Cloburne, Tex. Cleveland, Ohio	4.48		2. 82 1. 20	6.41	9. 02 5. 36		1.32 4.18	0.51 4.90	2. 51 1. 97	0.47	1.38	1.56	
Cleveland, Ohio Clyde, Ohio Cockburn Harbor, N. S College City, Cal College Hill, Ohio Collinsville, Ill Comfort, Tex Conception, Mo Contoocook, N. H	3. 17	1.46	(1, 20	2. 69 (¹)	2.55					3.85 2.68		1.59 5.04	42.83
Cockburn Harbor, N.S	ò. 40	0. 81	0.67	0. 25	0.80	0.61	0.97	(1)	(1)	(1)	1.97	5.30	
College City, Cal	1.60 6.31	0.47 1.80	0. 56 0. 20	0.76 4.50	(³) 2. 25	0. 23 4. 10		(2) 4. 10	0.05 3.25	0.96 4.00		3.55 1.60	
Collinsville, Ill	3.06	0.76	0.45	4.32	2, 56	7.42	2.37	2, 93	6.78	5, 52	2.54	1.55	40, 26
Comfort, Tex	(1)	0. 12		8. 34	6. 14	0.05		2. 27	3.62	0.73		1.04	
Contocook N H	0.52 5.30	(1) 3, 80	0. 10 0. 82	4. 93 3. 05	1.96 2.95		1.75 (¹)	1.85 6.85	2.47 2.65	4.83 4.15			
COHOROGO A. A. A.	J. JU	5. 50			50	,					10	,	

¹ No record.

² Inappreciable.

Monthly and annual precipitation, from reports made by voluntary observers of the Signal Service, United States Army, &c.—Continued.

Stations.	January.	February.	March.	ri).	y.		٠.	Angust.	September.	October.	November.	December.	Annual
	Jan	Fe	M.	April.	May.	Jane.	July.	Ang	Sept	Oct	Nov	Dec	Ann
	In.	7-	In.	7		In.	In.	In.				In.	In.
Cooperstown, N. Y. Cornish, Me Cresco, Iowa. Cresco, Iowa. Cresco, Iowa. Cresco, Nebr. Cumberland, Md Dale Enterprise, Va Deerfield, Mass. De Soto, Nebr. Distributing Reservoir, D. C. Dorset, Vt. Dorset, N. J. Drifton, Pa Dudley, Mass. Delley, Mass. Delley, Mass. Delley, Mass. Delley, Mass. Delley, Mass. Embarras, Wis Falls Brook, Cal Fall Brook, Cal Fall River, Mass Fallaton, Md Forsyth, Ga. Fort Madison, Iowa. Fort Madison, Iowa. Fort Madison, Iowa. Franklin, Pa Franklin, Pa Franklin, Wis Fremont, Nebr. Gallinas Spring, N. Mex Garrettsville, Ohio Genoa, Nobr Germantown, Pa Grand Cotesn, La Grand Cotesn, La Grand Cotesn, La Grandinor, Ind Grens Springs, Ala Green Springs, Ala Grifford, Ind Guttenberg, Iowa Hartford, Conn Havarford, College, Pa Helvetis, W. Va Hiram, Ohio Hudson, Mich Humboldt, Iowa Huntaville, Tex Hydesville, Cal Independence, Iowa Hiram, Ohio Hudson, Mich Humboldt, Iowa Huntaville, Tex Hydesville, Cal Independence, Kana Independence, Kana Independence, Kana Independence, Mo Indianola, Iowa. Leach Hill, Ark Leach Hill, Ark	8.00	In. 2.46 4.50	0.55	In. 1. 94 2. 93 1. 66	In. 3.39	8.50	8.00	9. 08	1.96	In. 4.19 3.85 1.14 1.07 4.14 12.60 6.84 2.01	3. 05	2, 15	38, 36
Creeco Towa	1.21	4. 50 0. 48	2.00	2.93 1.66	2. 94 1. 16	5. 23 3. 99	6, 64 5, 04	6.08	2.00	3.85	5. 93 0. 39	3.30	49. 40 25. 93
Crete, Nebr	0.08	0.48	0.75 0.17	4.08	4. 32	2. 54 0. 86	7. 25	4.45 2.70	2. 09	1.07	0.72	1.49 0.71	26. 21
Cumberland, Md	3.80	2. 52 2. 94 (¹) 0. 78 4. 52	1.30	1.79 2.85	3.77 5.37	0. 88 4. 14	7. 25 1. 01 2. 86	3.87 3.09	0.75	4. 14	1.73 4.05	1.55 2.53	27. 09 47. 16
Deerfield, Mass	(1)	(')	(1)	8. 40	2.70	3. 62	2. 25 3. 55	(1)	1. 28	6. 84	6. 09	3. 07	
De Soto, Nebr	0.65	0.78	0.28	8. 52 1 74	3.70	4. 26 3. 64	3.55	4. 02 7. 81	1.57 8.01	2.01 9.57	1.84 3.47	1.73 1.61	27. 36
Dorset, Vt	6. 26	3. 37	1.44	2.08	8. 09	3.76	1. 45 4. 35	5. 66		2. 52	3. 69	3, 03	44. 17 44. 92
Dover, N. J	4. 25	0. 04 8. 39	1.45	1.02	3.00	1.00	4.95	7.00 7.44 5.90 8.77 7.76	0.95	5. 85	7. 90	4. 10	41.51
Dudley, Mass	8.86	4. 15	(1)	1. 90	2. 30 3. 15	2.00	1. 26	5. 90	1.39 1.75	5. 66 3. 74	5. 46 4. 12	2.72	•••••
Dyberry, Pa	4. 52	4. 15 2. 75 4. 18 6. 08 (¹) 0. 80 8. 74 0. 46	1.03	2. 48	2. 35	8. 92	1.70	8.77	1. 04 0. 59 1. 13 10. 75	3. 52 5. 37	4.41	2. 23	38.72
Rest Portland. Oreg	a. 16	6. 08	(2)	1.08	(1)	8. 11	0.04	0.00	1. 13	1. 15	4.03 4.01	4, 13	40.80
Rik Falls, Kans	(1)	(1)	1.00	19.00	6. 50	5. 75	(1)	(¹) 5. 15	10.75	1. 15 2. 00	1.75 2.65	1.00	l
Empiris, Wis	4.78	8.74	1. 94	2. 80	3. 69	2.40	2. 10	0. 10	2. 05 0. 88	2.40 7.72	28 200	3.75 3.44	42.65
Emporia, Kans	1.20	0.46	0.74	5.70	2. 94 4. 32 3. 77 5. 37 2. 79 3. 09 3. 15 2. 35 2. 29 (1) 6. 50 5. 35 3. 69 4. 18 3. 28	3. 85	4. 35 4. 95 (1) 1. 26 1. 70 2. 63 0. 04 (1) 10. 45 2. 10	(¹) 2. 12 0. 00	5. 38 2. 67	1. 28 1. 42	0.95	0.70	36.82
Factorville, N. Y	2.14	7.06 1.87	0. 33	1.59	3. 23 3. 91	1. <b>4</b> 0 3. 90	(¹) 2.99		2. 67 1. 87	1.42 5.60	2.24	7.41 1.26	81.06
Fairbury, Nebr	(1)	(1)	(1)	5. 33	3. 28	1.37	7. 56	11 04	1.87 2.91	1.81	(1)	1. 17	
Fall River, Mass	5.11	(¹) 0. 13 2. 80	1. 20	2.70	4.30	3. 90 1. 37 0. 11 2. 65 1. 02 4. 01 4. 93 3. 82 4. 14 2. 97 5. 34 3. 68 5. 06	0.00 1.35	0. 02 5. 17 7. 56	0.00 1.33	0.00 4.45	5.92 3.10	1.13 3.56	11.41 37.72
Fallsington, Pa	4.03	4. 91 4. 50 2. 92	1. 19	2.30	1.51	1.02	4. 05 8. 33	7. 56	1.07	4. 23	3. 10 3. 58	3, 26	37.72 88.71
Fallston, Md	7.94	9 92	1.44 2.79	1.60	6. 28	4.01	8.33	10. 75 5. 88	0. 64 8. 67	7.07	4. 68 3. 26	2.64	50. 68 55. 90
Fort Madison, Iowa	2, 20	(¹) 1. 50	0.00	8. 27	1. 53	4. 93	2. 40 (1) 2. 76 1. 61	3. 50	4. 18 3. 55	4. 45 4. 23 7. 07 4. 10 3. 15 1. 65	0. 53 0. 50	1.80	
Fort Wayne Ind	(')	1.50	1.75 0.50	8.73 4.11	2.48	3, 82	(¹)	(¹) 4.77	3. 55 8. 15	1.65 4.90	0. 50 4. 25	(1) 2, 66	
Frankfort, Ky	6. 42	(¹) 2. 91	1. 31	4. 87	5. 07	2. 97	1.61	1.88	3, 64	4.78	3.38	2.60	41.53
Franklin, Pa	4.88	2.08	1.70	2.18	3.70	6.75	2.50 7.61	6. 22	3.09	4.50		2.58	43. OL
Fremont, Nebr	0.50	(¹) 0. 92	0. 33	5. 55	4. 30	3. 23	3. 36	5. 11	4. 25 1. 08	(¹) 3. 81	(¹) 1. 38	(¹) 1.07	30. 64
Gallinas Spring, N. Mex	5.26	(¹)	1.00 2.18	0. 95 2. 50	1.77	1.68 5.06	1.65	2. 51	(²) 1. 98	0.35	0.25	1.00	
Garrettaville, Ohio	3. 22	(¹) 6. 44 1. 58		2.70	1. 77 3. 41 3. 66 2. 17 3. 65 4. 06 6. 12 9. 65 1. 99 5. 88 7. 85 2. 09 1. 56 8. 42 5. 82 8. 50	6. 05	5, 55	6. 22 6. 06 5. 11 2. 51 3. 21 7. 44 4. 09 8. 80	2. 31 2. 29 0. 83	8.94 4.29	2. 86 3. 14	1.78	43.04
Germantown Pa	1.00	0.57 4.63 2.23 1.62 0.28	1. 37 0. 34 1. 20 1. 34 5. 37 0. 65 1. 28 2. 92 2. 61	2.80	2.17	2.48 0.92	1. 39	4.09 8.80	2. 29	1.60 5.58	1.82	0. 65 3. 33	23. 22
Grampian Hills, Pa	3, 82	2. 23	1. 84	3. 63	4. 06	2.96	(¹) 6. 14 5. 21	8. 03 7. 57	1. 14 10. 58	2. 92	8 73	2. 72 2. 70	49 79
Grand Coteau, La	0.70	0.98	5.87 0.65	0.75	6.12	5. 54 0. 80	19 RQ	7.57	10. 58	0.56	4.03 2.08 8.30	2.70 5.48	60. 64
Great Falls Reservoir, Md	8. 28	4. 15	1. 28	1. 12	1.99	2.62	0.20	(¹) 6. 03	(¹) 2. 68	(¹) 8. 23	3. 30	2. 16	37. 08
Green Springs Ala	8.94 7.04	3.83 2.72 2.76 0.58	2.92	3. 17 2.69	5.88 7.85	4.00 8.16	2. 51 2. 95	(¹) 2. 23 5. 46	1.84	1. 37	7.33	1 5 23	
Guilford, Ind	(1)	2.76	0. 87 0. 41 0. 93	3. 94	2.00	4.44	8. 25	5. 46	(¹) 3. 50	(¹) 2.58	(¹) 2.55	(¹) 1.75	
Guttenberg, Iowa	1.23	0. 58 8. 45		2.27	1.56 R 42	4.50 2.79	4 04	4.76 8.84	4.81 2.26	1.41	(1)	2. 26	4
Harvard, Nebr	(1)	(1)	(1)	3. 00	5. 25	(¹) 1.61	(4)	(9)	1.50	4.00	1.50	1.75	
Haverford College, Pa	3.78 5.90	2.65	0.78 2.54	8. 82 5. 04	5.82 8.50	1.61 4.66	(')	(¹) 8 14	(¹) 1.42	4.00 (1) 5.80	(¹) 4.06	(1)	46, 31
Hiram, Ohio	8. 01	1.70	0.78 0.78 2.54 1.80 0.12 1.39			7 661	K 27	(¹) (¹) 8. 14 6. 66	2.81	I K 10	0 70	2. 02	46.38
Hudson, Mich	1.07	1.09	0.25	2.80	4.72	2. 82 (¹) 5. 96	4.06			4. 66 (1) 4. 17 1. 46	3.28	1.62 0.96	
Humphrey, N. Y	2.51	1.57	1.39	2. 96	(¹) 4.99	5. 96	(¹) 2. 38	(¹) 10. 11 1. 86	4.44	4. 17	0. 65 2. 71 2. 26	3.31	46, 40
Huntaville, Tex	(¹) 4 61	8.01	4. 51 0. 24 0. 53	2.80 (1) 2.86 7.45 1.76 2.80	8. 29	2. 02 1. 00	1 2.59	1.86	5. 35	1.46	2. 26	8.88 9.31	
Independence, Iowa	1.62	8. 43 0. 86 1. 32 0. 75	0. 53	2. 80	(¹) 8. 83	5.78	(¹) 4.99	(¹) 7. 10	(1) 3. 75 7. 94 8. 63	1.62	18. 37 0. 26	1.80	34. 44
Independence, Kana	2. 12 0. 75	1.32	1.81 0.40	7 85	D. 02	5. 27 7. 19	5. 02 6. 45	7. 46 9. 36	7. 94 8. 63	1.79 2.84	0.58	0.95	44.40
Indianola, Iowa	1.42	0. 74 1. 59	(²)	8. 97 1. 73	1.95 1.89	(1)		7.98	2. 91 2. 36	8. 85	l às	(0)	1
Jacksonborough Ohio	z. 09   4. 05	1.59 2.95	(2) 0.49 1.22 1.13	1.73 8.17		8. 69 8. 25	2. 84 8. 65	7. 98 8. 14 5. 85	2.36 4.50	5. 26 2. 00	2.77	1.63	35. 10 37. 01
Jeffersonville, Ind	5. 85	2. 95 2. 41 2. 84 0. 49	1. 13	1.73 8.17 4.29 2.20 (²) 2.50 2.93 8.72	8. 87	3. 25 2. 68 3. 48	8. 65 2. 44 2. 28	2.08	5.31	4. 28	3.65	2.43	20.92
Kalamasoo, Mich Kenewick, Wash	4.58 0.51	2. 84 0. 49	1.01	2. 20	1.44 1.38	0 93	2. 28	8.94	3. 56 0. 41	0.26	3.11	2. 63 1. 03	1
Kew, W. I.	1. 25	1.03		2. 50	8. 25 4. 25	1. 10	(*) 7. 50	(¹) (¹) 4. 30	(1) 5. 36	(¹) 4.50	6.72	5,08	i
Laconia, Ind	3.90	2.24	0.77	2.93	4. 25 3. 51	3. 23 8. 67	1. 33 4. 67	4.30	5. 36 4. 64	4.50 2.96	3.64	2. 24	40.69 38.75
La Grange, Ind	8.96	2. 24 2. 02 1. 43 4. 37	0.83	1.7	4. 18 1. 94	3. 07 (1) 2. 92	(¹) 3.72	4. 93 4. 75 7. 97	(¹) 1.45	(¹) 2.49	8. 20 5. 86	2. 24 2. 54 8. 60	ec. /5
Lake Village, N. H	4.71	4.37	1.45 0.60	2. 58 2. 38	1. 94 1. 85	2.92 5.88	3.72	7. 97 6. 75	1.45 3.40	2.49 3.60	5. 86 8. 05	4.40	43.95
Lawrence, Kans	1.66	0. 45 1. 12 1. 47	0.87	(')	(¹) 8.73	2.89	2.04 6.08	(1)	(¹) 3. 64	3. 32 1. 22	(¹)	1. 25	
Lead Hill, Ark	2. 65	1.47	3. 60	5. 38	8.73	3. 60	8. 31	4, 14	3.64	1. 22	(¹) 2. 50	2. 30	2. 63

^{&#}x27; No record.

³ Inappreciable.

Monthly and annual precipitation, from reports made by voluntary observers of the Signal Service, United States Army, &c.—Continued.

											<del></del>		
Stations.	January.	February.	March.	April.	May.	June.	July.	Angust.	September.	October.	Nevember	December.	Annual.
Leicester, Mass Lenoir, N. C. Le Roy, N. Y. Liberty Hill, La Limona, Fla Lincolnton, N. C. Logan, Iowa. Logansport, Ind Luling, La. Lunenburg, Vt. Madison, Nobr Madison, Nobr Madison, Wis Mahanoy Plane, Pa Manace, Fla Manchester, Iowa Manhattan, Kans Manistique, Mich Maritowec, Wis Marietta. Cal Marion, Va Marietta. Cal Marion, Va Marietta. Cal Marion, Vi Maud, Kans Mauzy, Ind Mayport, Fla Mazatian, Mex McDonogh, Md Menand Station, N. Y Merritt's Island, Fla Milan, Tem Milledgeville, Ga. Milton, Mass Minneapolis, Minn Monticelle, Iowa Moorestown, N. J Mottville, Mich Moorestown, N. J Mottville, Mich Moorestown, N. J Mouttville, Mich Mountainville, N. Y Mount Forest, Canada Mount Ho, Ark Muscatine, Iowa Navatt Point, R. 1 Nowlleville, Wis Nephi, Utah New Bedford, Mass Nowport, Vt Nowth Colebrook, Conn Northfield, Minn North Lewisburg, Ohio Northyort, Mich Nowtheld, Cal Orono, Mc Oroville, Cal Oskalossa, Iowa Ottumwa, Iowa Pacolet, S. C Palerno, N. Y Pearia, Ili Phillipsburg, N. J Penria, Ili Phillipsburg, N. J Penro, Lili Princeton, Mass Princeton, Mass Princeton, Mass Princeton, N. J Providence, R. I			In 02 02 02 02 02 02 02 02 02 02 02 02 02	In. 85.0.2010 8.3.2010 8.3.2010 8.3.2010 8.3.2010 8.3.2010 8.3.2010 8.3.2010 8.3.2010 8.3.2010 8.3.2010 8.3.2010 8.3.2010 8.3.2010 8.3.2010 8.3.2010 8.3.2010 8.3.2010 8.3.2010 8.3.2010 8.3.2010 8.3.2010 8.3.2010 8.3.2010 8.3.2010 8.3.2010 8.3.2010 8.3.2010 8.3.2010 8.3.2010 8.3.2010 8.3.2010 8.3.2010 8.3.2010 8.3.2010 8.3.2010 8.3.2010 8.3.2010 8.3.2010 8.3.2010 8.3.2010 8.3.2010 8.3.2010 8.3.2010 8.3.2010 8.3.2010 8.3.2010 8.3.2010 8.3.2010 8.3.2010 8.3.2010 8.3.2010 8.3.2010 8.3.2010 8.3.2010 8.3.2010 8.3.2010 8.3.2010 8.3.2010 8.3.2010 8.3.2010 8.3.2010 8.3.2010 8.3.2010 8.3.2010 8.3.2010 8.3.2010 8.3.2010 8.3.2010 8.3.2010 8.3.2010 8.3.2010 8.3.2010 8.3.2010 8.3.2010 8.3.2010 8.3.2010 8.3.2010 8.3.2010 8.3.2010 8.3.2010 8.3.2010 8.3.2010 8.3.2010 8.3.2010 8.3.2010 8.3.2010 8.3.2010 8.3.2010 8.3.2010 8.3.2010 8.3.2010 8.3.2010 8.3.2010 8.3.2010 8.3.2010 8.3.2010 8.3.2010 8.3.2010 8.3.2010 8.3.2010 8.3.2010 8.3.2010 8.3.2010 8.3.2010 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8.3.2010 8.3.2010 8.3.2010 8.3.2010 8.3.2010 8.3.2010 8.3.2010 8.3.2010 8.3.2010 8.3.2010 8.3.201	7.00 10.178 65.022 1.00 10.178 65.022 1.00 10.178 65.022 1.00 10.178 65.022 1.00 10.178 65.022 1.00 10.178 65.022 1.00 10.178 65.022 1.00 10.178 65.022 1.00 10.178 65.022 1.00 10.178 65.022 1.00 10.178 65.022 1.00 10.178 65.022 1.00 10.178 65.022 1.00 10.178 65.022 1.00 10.178 65.022 1.00 10.178 65.022 1.00 10.178 65.022 1.00 10.178 65.022 1.00 10.178 65.022 1.00 10.178 65.022 1.00 10.178 65.022 1.00 10.178 65.022 1.00 10.178 65.022 1.00 10.178 65.022 1.00 10.178 65.022 1.00 10.178 65.022 1.00 10.178 65.022 1.00 10.178 65.022 1.00 10.178 65.022 1.00 10.178 65.022 1.00 10.178 65.022 1.00 10.178 65.022 1.00 10.178 65.022 1.00 10.178 65.022 1.00 10.178 65.022 1.00 10.178 65.022 1.00 10.178 65.022 1.00 10.178 65.022 1.00 10.178 65.022 1.00 10.178 65.022 1.00 10.178 65.022 1.00 10.178 65.022 1.00 10.178 65.022 1.00 10.178 65.022 1.00 10.178 65.022 1.00 10.178 65.022 1.00 10.178 65.022 1.00 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In. 70 6.2.70 4.1. 3.77 6.5. 6.5. 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Orono, Mo. Orovillo, Cal. Okalonoa, Iowa Ottumwa, Iowa Pacolet, S. C. Palormo, N. Y	4.73 (¹) (¹) 1.33 (¹) 3.41	4. 45 (¹) 1. 48 1. 90 (¹) 2. 55	0. 30 0. 90 1. 07 2. 78 0. 25 (1) 0. 03 2. 75 0. 68	1. 50	3. 38 (¹) (¹) 1. 15 6. 14	4. 00 0. 39 (¹) 5. 44 8. 44	4. 70 ( ² ) ( ¹ ) 4. 36 1. 22 3. 85	7.36 0.00 7.09 4.48 2.00 2.98	2. 52 0. 20 3. 39 2. 68 2. 92 3. 99	2.65	5, 37 11, 27 0, 81 (¹) 3, 22 2, 50	5, 53 1, 69 (1) 3, 06	52. 99 33. 23
Paramaribo (Dutch Guiana), S. A. Paterson, N. J. Penn Yan, N. Y. Penra, Ili Phillipaburg, N. J. Piereo City, Mo Pleasant Grove, Wash. Point Pleasant, La Portsmouth, Ohlo Powsy, Cal Prairio du Chien, Wis Princeton, Cal Princeton, Mass Princeton, N. J. Providence, R. I.	7. 27 3. 47 2. 14 2. 63 3. 74 1. 20 0. 90 4. 30 6. 41 0. 72 1. 01 1. 66 8. 75 (1) 5. 26	5. 09 4. 09 1. 61 0. 87 4. 00 0. 90 0. 44 4. 72 2. 41 0. 35 1. 00 0. 57 2. 94 (¹) 3. 18	0. 34 0. 16 (¹) 1. 41	1. 72 4. 44 (¹) 0. 80 0. 03 19. 58 4. 04 2. 05 2. 46 0. 98 2. 93	(1) 2. 07 1. 70 2. 23 5. 50 1. 18 2. 97 3. 72	3. 86 2. 39 0. 07 2. 53 6. 57 1. 67	11. 17 (1) 2. 86 4. 78 2. 51 8. 70 0. 01 4. 63 2. 12 0. 00 6. 37 0. 00 4. 23 2. 81 (1)	8. 01 6. 48 4. 27 2. 64 7. 35 7. 20 (*) 5. 52 (*) 5. 82 0. 00 6. 89 5. 49 (')	(')	0.06 1.22 3.69 0.06 1.72	(1)	4.78 1.91 2.54	37. 28 7. K3 30. 80 46 51

¹ No record.

^{*}Inapprociable.

Monthly and annual precipitation, from reports made by voluntary observers of the Signal Service, United States Army,  $\delta v$ .—Continued.

Rower   Mass   4.60   3.91   1.30   3.13   3.05   2.26   4.16   7.37   1.80   4.08   5.55   (¹)	Stations.	January.	February.	March.	April.	May.	June.	July.	August.	September	October.	November	December	Annual.
Waterville, Me	Raleigh, N. C. Readington, N. J. Readington, N. J. Recediving Reservoir, D. C. Richardton, Dak Richmond, Ky Rilev, Ill. Rockford, Ill. Rockford, Ill. Rockford, Ill. Rockford, Ill. Round Grove, Iowa Rowe, Mass. Ruggies, Ohio. Seramento, Cal. Salem, N. J. Salem, N. J. Salina, Kans Salinas City, Cal. Salina, Kans Salinas City, Cal. Salem, N. J. Sandwich, Ill. Ban Rafael, Cal. Sherlock, Kans. Snowville, Va. Soonerset, Mass. Somerset, Mass. Somerset, Mass. Somerville, N. J. South Bethlehem, Pa. South Bethlehem, Pa. South Bethlehem, Pa. South Branston, Ill. Southington, Conn South Orange, N. J. Spiceland, Ind Springfield, Mo. Stateburg, S. C. Statesville, N. C. Statesville, N. C. Sterling, Kans. Stockham, Nobr Strafford, Vt. Summan, Ind Sussex, Wis. Swanwick, Ill. Swartz Creek, Mich. Sycamore, Ill. Tacoma, Wash Tallabassee, Fla Taunton, Mass. Tecre Haute, Ind Thornville, Mich. Troy, Pa. Tucson, Aris. Traverse City, Mich. Troy, Pa. Tucson, Aris. Variety Mills, Va Vermillion, Dak Versulin, N. J. Voluntown, Conn Washington, Pa. Washington, Pa. Washington, Pa. Washington, Pa. Washington, Ohio Webater, Dak	In. 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(3.4.0.0.10.3.2.4.2.2.4.1.1.3.3.4.5.4.5.4.3.2.4.3.4.3.4.5.4.3.4.5.4.3.4.5.4.3.4.5.4.3.4.5.4.3.4.5.4.3.4.5.4.3.4.5.4.3.4.5.4.3.4.5.4.3.4.5.4.3.4.5.4.3.4.5.4.3.4.5.4.3.4.5.4.3.4.5.4.3.4.5.4.3.4.5.4.3.4.5.4.3.4.5.4.3.4.5.4.3.4.5.4.3.4.5.4.3.4.5.4.3.4.5.4.3.4.5.4.3.4.5.4.3.4.5.4.3.4.5.4.3.4.5.4.3.4.5.4.3.4.5.4.3.4.5.4.3.4.5.4.3.4.5.4.3.4.5.4.3.4.5.4.3.4.5.4.3.4.5.4.3.4.5.4.3.4.5.4.3.4.5.4.3.4.5.4.3.4.5.4.3.4.5.4.3.4.5.4.3.4.5.4.3.4.5.4.3.4.5.4.3.4.5.4.3.4.5.4.3.4.5.4.3.4.5.4.3.4.5.4.3.4.5.4.3.4.5.4.3.4.5.4.3.4.5.4.3.4.5.4.3.4.5.4.3.4.5.4.3.4.5.4.3.4.5.4.3.4.5.4.3.4.5.4.3.4.5.4.3.4.5.4.3.4.5.4.3.4.5.4.3.4.5.4.3.4.5.4.3.4.5.4.3.4.5.4.3.4.5.4.3.4.5.4.3.4.5.4.3.4.5.4.3.4.5.4.3.4.5.4.3.4.5.4.3.4.5.4.3.4.5.4.3.4.5.4.3.4.5.4.3.4.5.4.3.4.5.4.3.4.5.4.3.4.5.4.3.4.5.4.3.4.5.4.3.4.5.4.3.4.5.4.3.4.5.4.3.4.5.4.3.4.5.4.3.4.5.4.3.4.5.4.3.4.5.4.3.4.5.4.3.4.5.4.3.4.5.4.3.4.5.4.3.4.5.4.3.4.5.4.3.4.5.4.3.4.5.4.3.4.5.4.3.4.5.4.3.4.5.4.3.4.5.4.3.4.5.4.3.4.5.4.3.4.5.4.3.4.5.4.3.4.5.4.3.4.5.4.3.4.5.4.3.4.5.4.3.4.5.4.3.4.5.4.3.4.5.4.3.4.5.4.3.4.5.4.3.4.5.4.3.4.5.4.3.4.5.4.3.4.5.4.3.4.5.4.3.4.5.4.3.4.5.4.3.4.5.4.3.4.5.4.3.4.5.4.3.4.5.4.3.4.5.4.3.4.5.4.3.4.5.4.3.4.5.4.3.4.5.4.3.4.5.4.3.4.5.4.3.4.5.4.3.4.5.4.3.4.5.4.3.4.5.4.3.4.5.4.3.4.5.4.3.4.5.4.3.4.5.4.3.4.5.4.3.4.5.4.3.4.5.4.3.4.5.4.3.4.5.4.3.4.5.4.3.4.5.4.3.4.5.4.3.4.5.4.3.4.5.4.3.4.5.4.3.4.5.4.3.4.5.4.3.4.5.4.3.4.5.4.3.4.5.4.3.4.5.4.3.4.5.4.3.4.5.4.3.4.5.4.3.4.5.4.3.4.5.4.3.4.5.4.3.4.5.4.3.4.5.4.3.4.5.4.3.4.5.4.3.4.5.4.3.4.5.4.3.4.5.4.3.4.5.4.3.4.5.4.3.4.5.4.3.4.5.4.3.4.5.4.3.4.5.4.3.4.5.4.3.4.5.4.3.4.5.4.3.4.5.4.3.4.5.4.5	7.27 1810 1 0 1 0 1 0 1 0 1 0 1 0 1 0 1 0 1	1.835.0.105	4286458882881_773589838_8_99_98834_75528787727598_19_9888133_5735881155_7_9881155_7_98841848888567874881155_7_98841	7.88 (4) (-) 7.88 (4) (-) 8.0 (8) (-) 1.50 (4) (4) (2.5 (5) (4) (5) (4) (5) (6) (6) (6) (7) (7) (8) (8) (7) (7) (8) (8) (7) (7) (8) (8) (7) (8) (8) (7) (8) (8) (8) (7) (8) (8) (8) (8) (8) (8) (8) (8) (8) (8	7.0.5733 3.5.888 4.5654 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56 5.5.56	7.914300098	In. 30.68 3.105 3.00 2.55 3.57 (1) 1.35 3.17 6.69 1.30 3.90 2.57 3.57 (2) 2.60 2.11 3.50 2.11 3.50 2.11 3.50 2.11 3.50 2.11 3.50 2.11 3.50 2.11 3.50 2.11 3.50 2.11 3.50 2.11 3.50 2.11 3.50 2.11 3.50 2.11 3.50 2.11 3.50 2.11 3.50 2.11 3.50 2.11 3.50 2.11 3.50 2.11 3.50 2.11 3.50 2.11 3.50 2.11 3.50 2.11 3.50 3.11 3.50 3.11 3.50 3.11 3.50 3.11 3.50 3.11 3.50 3.11 3.50 3.11 3.50 3.11 3.50 3.11 3.50 3.11 3.50 3.11 3.50 3.11 3.50 3.11 3.50 3.11 3.50 3.11 3.50 3.11 3.50 3.11 3.50 3.11 3.50 3.11 3.50 3.11 3.50 3.11 3.50 3.11 3.50 3.11 3.50 3.11 3.50 3.11 3.50 3.11 3.50 3.11 3.50 3.11 3.50 3.11 3.50 3.11 3.50 3.11 3.50 3.11 3.50 3.11 3.50 3.11 3.50 3.11 3.50 3.11 3.50 3.11 3.50 3.11 3.50 3.11 3.50 3.11 3.50 3.11 3.50 3.11 3.50 3.11 3.50 3.11 3.50 3.11 3.50 3.11 3.50 3.11 3.50 3.11 3.50 3.11 3.50 3.11 3.50 3.11 3.50 3.11 3.50 3.11 3.50 3.11 3.50 3.11 3.50 3.11 3.50 3.11 3.50 3.11 3.50 3.11 3.50 3.11 3.50 3.11 3.50 3.11 3.50 3.11 3.50 3.11 3.50 3.11 3.50 3.11 3.50 3.11 3.50 3.11 3.50 3.11 3.50 3.11 3.50 3.11 3.50 3.11 3.50 3.11 3.50 3.11 3.50 3.11 3.50 3.11 3.50 3.11 3.50 3.11 3.50 3.11 3.50 3.11 3.50 3.11 3.50 3.11 3.50 3.11 3.50 3.11 3.50 3.11 3.50 3.11 3.50 3.11 3.50 3.11 3.50 3.11 3.50 3.11 3.50 3.11 3.50 3.11 3.50 3.11 3.50 3.11 3.50 3.11 3.50 3.11 3.50 3.11 3.50 3.11 3.50 3.11 3.50 3.11 3.50 3.11 3.50 3.11 3.50 3.11 3.50 3.11 3.50 3.11 3.50 3.11 3.50 3.11 3.50 3.11 3.50 3.11 3.50 3.11 3.50 3.11 3.50 3.11 3.50 3.11 3.50 3.11 3.50 3.11 3.50 3.11 3.50 3.11 3.50 3.11 3.50 3.11 3.50 3.11 3.50 3.11 3.50 3.11 3.50 3.11 3.50 3.11 3.50 3.11 3.50 3.11 3.50 3.11 3.50 3.11 3.50 3.11 3.50 3.11 3.50 3.11 3.50 3.11 3.50 3.11 3.50 3.11 3.50 3.11 3.50 3.11 3.50 3.11 3.50 3.11 3.50 3.11 3.50 3.11 3.50 3.11 3.50 3.11 3.50 3.11 3.50 3.11 3.50 3.11 3.50 3.11 3.50 3.11 3.50 3.11 3.50 3.11 3.50 3.11 3.50 3.11 3.50 3.11 3.50 3.11 3.50 3.11 3.50 3.11 3.50 3.11 3.50 3.11 3.50 3.11 3.50 3.11 3.50 3.11 3.50 3.11 3.50 3.11 3.50 3.11 3.50 3.11 3.50 3.11 3.50 3.11 3.50 3.11 3.50 3.11 3.50 3.11 3.50 3.11 3.50 3.11 3.50 3.11 3.50 3.11 3.50 3.11 3.	7 10. 70 44. 43 35. 78 45. 14 27. 46 10. 71 31. 72 35. 73 37. 73 37. 73 38. 02 48. 50 49. 90 87. 24 49. 90 87. 24 40. 47 40. 90 87. 24 88. 84 88. 84 88. 84 88. 84 88. 84 88. 84 88. 84 88. 84 88. 84 88. 84 88. 84 88. 84 88. 84 88. 84 88. 84 88. 84 88. 84 88. 84 88. 84 88. 84 88. 84 88. 84 88. 84 88. 84 88. 84 88. 84 88. 84 88. 84 88. 84 88. 84 88. 84 88. 84 88. 84 88. 84 88. 84 88. 84 88. 84 88. 84 88. 84 88. 84 88. 84 88. 84 88. 84 88. 84 88. 84 88. 84 88. 84

Monthly and annual precipitation, from reports made by voluntary observers of the Signal Service, United States Army, &c.—Continued.

Stations.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Annual.
Wilkesbarro, Pa Williamstown, Mass Wilton Centre, Ill. Wolfborough, N. H. Woodstock, Md. Woodstock, N. H. Woodstock, Vt. Worcester, Mass Wyandotte, Kans Wysox, Pa Wytheville, Va Yates Centre, Kans Yellow Springs, Ohio Yutan, Nebr	4. 58 3. 62 5. 82 4. 42 5. 01 1. 31 (1) 3. 83 1. 80 (1)	3. 56 2. 76 5. 63 3. 81 3. 20 2. 85 3. 49 0. 83 (¹) 1. 94 0. 55 (¹)	0. 96 0. 63 1. 63 0. 79 2. 35 1. 55 0. 90 0. 48 (1) 1. 49	3. 37 2. 61 1. 81 1. 88 1. 98 2. 83 6. 00 0. 46 2. 19 5. 33 3. 92	2.00 1.61 2.09 2.54 1.68 2.04 8.26 2.79 7.04 4.68 4.26	1. 38 1. 45 4. 48 2. 73 5. 43 2. 28 3. 49 7. 03 2. 80 1. 40 8. 06	2. 87 4. 70 5. 23 3. 98 5. 07 3. 29 2. 10 4. 77 3. 27	6. 66 7. 79 7. 68 6. 43 12. 92 8. 48 6. 52 7. 86 5. 15 3. 70 2. 28 6. 47	1. 65 3. 34 0. 90 1. 52 2. 60 2. 35 0. 87 6. 83 1. 12 1. 66 6. 99	3. 12 3. 23 10. 23 4. 25 4. 70 4. 12 6. 63 4. 69 3. 60 2. 63	2. 97 (1) 6. 49 4. 93 5. 05 4. 53 5. 96 1. 52 2. 66 2. 56 0. 84	8. 43 (1) 4. 83 3. 02 5. 05 (1) 3. 09 0. 80 1. 91 8. 02 1. 08	49, 41 49, 47 44, 91 54, 80 42, 33 44, 25 84, 84 42, 45

¹ No record.

# APPENDIX 43.

# Monthly and annual precipitation at military post hospitals for the year ending December 31, 1885.

Stations.	January.	February.	March.	April	May.	June.	Jaly.	August.	September.	October.	November.	December.	Annual.
	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.
Abraham Lincoln, Fort, Dak	7.00	0.80	0.90	4.00	1.34	3, 20	2.82	2,50	0.22	0.70	0.40	0.50	18, 38
Alcatraz Island, Cal	0.52	0.12	0.38	2.52	0.02	0.14	0.02	0,00	0. 12		10.04	3, 47	17, 8
Angel Island, Cal	2,46	0.38	0.89	3, 31	0.18	0.01	0, 02	0.00	0.08		11,57	4.04	23. 50
Assinaboine, Fort, Mont	0,81	0.79	0. 15	0.38	0.43	2.01	1.58	0.54	0.01		0.03	0.08	0.79
	11.46	5.35	8, 55	8, 90	1.44	3, 42	(1)	(1)	(1)	(1)	(1)	(1)	40.00
Benicia Barracks, Cal	2,06	0.31	0.47	2, 24	(2)	(2)	(2)	(2)	0.02	0.30		5, 86	20. 01
Bidwell, Fort. Cal	2.09	1.33	0.04		(1)	(1)	0.38	(2)	0.10	0.73		3, 12	verse.
Brady, Fort, Mich	1.70	0.64	1,44	0.53	1.75	2.66	2, 61	2.24	3, 14	2.45		4.72	27.4
Bridger, Fort, Wyo	0.12	0.18	0.05		0.13	0.22	0.22	1.12	0.49			(4)	3.41
Brown, Fort, Tex	2.32	1.34	0, 55	0.80		0.34	0.00	0.50	3, 84	9.75		(1)	
Buford, Fort, Dak	0, 14	0.26		(1)	(1)	(1)	(1)	1.53	0.35	(1)	(1)	(1)	inches.
columbus, Fort, N. Y. H	3.19	5.71	1.73	2.11	1.72	1.72	3, 17	5.17	0.70	4, 83	4, 62	2.50	37.1
oncho, Fort, Tex	(1)	2.15	1.35		2.33	4.22	1.08	1.35	1.94	(1)	0,00	0.70	****
David's Island, N. Y	2.97	3. 60	0.28		1, 36		2, 45	5. 16	0, 30	4.33		3, 30	
Ellis, Fort, Mont	0.63	1.40	0.54		12, 26	7.35	3.61	1.25	1.20	1.50	1, 10	0.75	32.6
red Steele, Fort, Wyo	0.20	0.50	0.70				0.94	1.43	0,44	0.14			11.0
daston, Fort, Cal	5.73	6.26	0,38	2. 13	0.95		0.12	(2)	0.96		24, 54		51.3
Iamilton, Fort, N. Y	2, 24	4.34		2.06		1.30	(1)	(1)	(1)	(1)	(1)	(1)	
Ceogh, Fort, Mont	1.60	(2)	0.38				1.86	0.32	0.44	(1)	1.06	0. 22	80.0
Clamath, Fort, Oreg	2.97	3, 64	0.24	0.86		1.76	0, 26	0,00	0,30	0, 36	7.66		
owis, Fort, Colo	(1)	0.44	1.04	2,62			1.53	1.78	0.79	0.48	1,76		
Lyon, Fort, Colo	2, 20	1, 42	0.10	1.48		2, 55	2,42	2.20	0, 30	0, 60	2, 32	(1)	07.1
Madison Barracks, N. Y Mason, Fort. Cal	1.72	0, 32	0.40	3, 36			0,00	0.00	(2)	0, 42	5, 25	5, 94	27.1
McDermit, Fort, Nev	0.62	0.89	0.26	0.88			(2)	0.16	0.38	0.12	1. 82	0. 94	0.3
McDowell Fort Ariz	0.00	1.00	0.60	0,00		(1)	(2)	0, 56	0.96	0, 26		0, 87	0.0
McDowell, Fort, Ariz	3. 20	3,75	1. 24	2.30	4.44		2, 15	7.70	1.00	5, 83			
feade, Fort, Dak	(1)	0.23	0.52	1,30		3, 38	1.52	3.22	0.28	0.74	0.93		
Mojave, Fort, Ariz	0.00	0,00	0.18		(2)		0.00	(4)	0.00	(2)	1.70	0,02	2.2
Monroe, Fort, Va	3.56	2,43	1.36	0.24	5.85	1.70	0.07	1, 23	3.01	0, 62	5, 14		
Mount Vernon Barracks, Ala .	9.58	3.52	7.89	8, 15	4.19	6.79	4.07	4. 20	5.05	1.35	4, 32	2, 77	61.8
Niagara, Fort, N. Y	1.38	1.22	0.73	1.62	3.43	3, 93	0.93	3,98	2. 12	3, 20	1.96	1, 45	25, 0
Pembina, Fort, Dak	0.50	0.20	0, 75	5, 90			3, 10	1, 20	0.10	0.35	8, 70	1,05	25, 2
lattsburg Barracks, N. Y	2.57	1.33	0.30	1, 59			4,04	2, 10	3, 22	4,57	4.39	1,91	29. 0
reble, Fort, Me	3, 66	3.11	2.49	2, 45			3.40	1.96	2, 20	1.31	1,00		28, 4
residio of San Francisco, Cal.	2, 22	0.20	0,78		0.03		(2)	0.00	-0.08	0.46		4, 35	
landall, Fort, Dak	0. 20	0.42		1.78		6.16	3.83	5.17	2.30	1.16			94.5
Reno, Fort, Ind. T	(1)	(1)	1.84	2, 26		10, 33	1.63	2.66	3, 80				Core
Robinson, Fort, Nebr	0.45			2.60		3, 94	2,66	1.41	0, 50	1,80			19.0
Saint Augustine, Fla	4, 86		3.37	1.11			2.78		12.24	3.92	0, 52		
haw, Fort, Mont	1.87	0.78	0,35	0, 60			2, 21	1.35			0, 03		
Sisseton, Fort, Dak	0.48		0,40	1, 83		3, 74	2.79	1.53	4.10				
Snelling, Fort, Minn	0.22		0.25	2.78				3.10	4.40				
Sully, Fort, Dak	0, 18			1.53			2.10		1.58				16.0
Totten, Fort, Dak	0.18			3.21	1.66			2, 17	0, 11	0.62			
Townsend, Fort, Wash	2.44		0.36					0.00	2.10				18.0
Union, Fort, N. Mex	0. 24			0.72			2, 51	4.76	1.24				17.9
West Point, N. Y.	4. 90	(1)	2.40	(1)	(1)	3, 60		7, 50		5.80			
Wingate, Fort, N. Mex	0.46		(1)	(1)	1.14			1.14					
Yates, Fort, Dak	0.42	0.34	0.18	1, 92	1.78	5.68	2, 80	1.10	0, 24	0, 44	0.14	0.28	15, 3

¹ No record.

² Inappreciable.

### APPENDIX 44.

Monthly and annual precipitation, at stations on the Central Pacific and Southern Pacific Railroads and connecting branches, for the year ending December 31, 1885.

[Copied from the records on file at the office of the chief engineer of the Central Pacific Railread.]

Stations.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Annual.
25.50	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.
Alia, Cal	0.61	0, 60	0.10	0,64	0,00		0,00	0, 00	0,00	(1)	9 00	1.10	5.34
Antioch, Cal	1, 16		0.35			(2)	(2)	0.00	(t)	0, 00	4.87	(4)	0.01
Apros. Cal	2, 86			1,78	0.13		0, 18		0,07		10.65		20, 14
Auburn, Cal Battle Monntain, Nev	1.74	1.27	0.57	2.10		(7)	0.00		0.64		15,24		
Benson, Ariz	0.55	0.95	0.16	0,00	0.00	0, 44	0.00				0.72	1.00	*****
Beowawe Nov	0.50	0.40		0. 82			0, 10				1. 18		5.94
Beownwe, Nev Bishop Creek, Cal	0,00	0.00	0.67	0, 04	0.00	0, 10	0.00		0.00	0.02	P	0.00	
Bine Creek, Utah	0, 65	1.53	0, 05		1.27	1.73		1. 19	0.07		1.87		10.22
Boca, Cal	0.60	0.10	0.10			0.30		0.00					
Borden, Cal	2, 19	0.11		0.75		0.00	(1)	0,00		0,00	6.40	0.93	11.75
Brighton Cal	1.61	0.44		0.54			0,00	0,00			7.70		12,60
Brown, Nov.	0.52	0.03		1.43		1.06	0,00	0,00	0,00		1, 29		5.13
lyron, Cal	1.23	0.18		1,02	0.00	(1)	0,00	0.00	0, 00		6, 70	(3)	
Cabazon, Cal	0. 15		0.00		0.10		0, 00	0.00		0.00	(4)	(0)	20.00
Jalistoga, Cal	3, 05		0.71	0.95	0.00		0, 00		0, 12		15. 67	5,36	10, 06
athn. Nov	0.85		0,00	1.01			0,00					0.95	8, 20
asa Grande, Ariz	0.00	0. 30		0.00		0.00	0.75	D. 64			0, 23	0.00	2, 93
hico, Cal	2, 26	1.01	0, 30	0.75		0:58			0. 30		K 100		29, 41
isco, Cal	2.30	0.00	2.20	3.95		0, 00	0.07	0.00		0.17	17, 85	4.70	
Colfax, Cal	2.85	1,66		2, 29	0.00	1, 18	0,00				15, 48,		31, 53
olton, Cal	1.00	0.00	0.00	2.08		0,00	0,00	0.00	0.00		1, 90		5,74
orings, Utah	1.65	2.00	0.10	2.04		2.73		1.51	0, 15			1.49	16.54
Davisville, Cal.	1. 15	0.14		1.22				0.00				4, 56	15, 09
Oplano, Cal	0.13	2, 50	0:36	2, 54	0.03		0.00		(1)		(1)		
Deming, N. Mex	0,00	(1)	0.54	0,00	0. 77		1.38	0, 81	0.09		0.50		*****
Junnigan, Cal	1.66	0, 32		1.10			0,00		0,05		10, 47		18, 86
ilko, Nev	0.40	0.95				0.25	0,00	0.27	0.28		1.80		7.34
I Paso, Tex Emigrant Gap, Cal	2,68	(1)	(2)	(1)			0.76				0.49		30 YE
armington, Cal	1.03	2, 13		0.46			0.00	0.00	0.53		0.95		10, 14
resno City, Cal	0, 45			1. 11			0.00	0, 00	(6)				****
alt, Cal	1, 30	0, 12	0, 00	0.82	0,00	0,00	0.00	0,00	0.00	0,00	5, 56	2, 33	10.13
illroy, Cal						0, 12		0.00	(1)		0.77		-
iolconda, Nev	0. 25	0.40		1.38			0.00 6.00		0.00	0.05			2 60
Joshon, Cal.			0.04				0, 00	(1)	(1)		1.64		0.00
Iawthorne, Nev		0.00		0.86			0.10	(2)		0.00		0,45	*****
Iollister, Cal		0, 17	0.35			0.23	0.27	0,00	0, 00	0.00		1.12	8,08
lot Springs, Nev	0.40		0.00				0.00	(1)				9.22	
Iumboldt, Nevndio, Cal	0,00	0.10		0.10				0, 02	0.00	0,00	0.62	9, 33	1,00
one, Cal	1.74			1.55				0.00	0,00				
Ceeler, Cal	(4)	0.00	0.12	0.82	0.00	0.08	0.00	0.11	0.00	0.25	(9)	0, 36	*****
Ceope, Cal	0.30			1.47			0.06	(1)	0, 00	0, 28	3,73		7.29
Celton, Utah	0.50	0.75				0.00			0.10	0, 10	6, 22	2.24	10, 97
Chigsburg, Cal		0,00		1. 12		0.00			0,00	0, 00		4,93	16, 42
athron Cal	0.78	0.00		0.31	0.02	0. 20	0.02		0.00	0.00	6.46	0, 99	8,97
emoore, Cal	0.87	0.00	0.60	1.15	0.10	0, 00	0.00	0.00	0.00	0.03	8.16	1.20	12.11
Avermore, Cal	1, 72	0,36	0.78	1.29	0.08	0.00	(1)	0.00	0, 05	0,00	6, 20	1, 94	
ordsburg N. Mex		make where the	the state of	(3)	0, 40	611	0.75		0, 05	0, 20	0,55	0.70	

¹ No record.

^{*}Inappreciable.

⁷ Discontinued.

### Monthly and annual precipitation, at stations on the Central Pacific, &c.—Continued.

Stations.	January.	February	March.	April.	May.	June.	July.	Angust.	September.	October.	November.	December.	Aunual.
al socialization	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.
Mammoth Tank, Cal	0.00	0,02	0.00	0.00	0.00	0.00	(1)	0, 62	0.00	0.00	1.01	0.00	1.65
Maricopa, Ariz	0.00	0,00	0.07	0.00	0.00		0. 22	0.20	0.00	0.00	(2)	0.30	
Martinez, Cal	1.74	0. 17	0.55	1.75					0.06	0.15	8.08	4. 11	16. 61
Martinez, Cal Maryaville, Cal Menlo Park, Cal	(2)	0.07	0.12			0.15	0.00	0.00	0.02	0, 09	8. 23 6. 22	(2) 2, 17	19 00
Monard ('a)	1.89 0.85	D. 00								0.00	5.82	1.08	13.03
Modesta Cal	0.90	0.00	0.70	0. 98			0.00	0.00	0.00	0,00	(2)	0.85	9, 80
Menlo Park, Cal. Merced, Cal Modesto, Cal Modesto, Cal Mojave, Cal Monterey, Cal Napa City, Cal Newhall, Cal Niles, Cal Oakland, Cal Ogden City, Utah Orland, Cal Païaro, Cal	0.00	0.00	0.00	0, 61		0,00	0.71	0.00	0.00	0.00	1.25	0.16	2, 87
Monterey Cal	1. 22	0.09	0:40		0, 20	0.03	0.00	0.00	0.00	0.00	6.65		12.02
Nana City Cal	1.96	0.40	0.43			0.00	0.00	0.00	0.05	0. 61	8. 51	4, 35	
Newhall, Cal	0.47	0.00	0.07	1.75	0.00		0.02	0.00	0.00	0,00	9, 01		13.63
Niles, Cal	1.58	0.15	0, 66				0.00	0.00	0.00	0.35	8.78		
Oakland, Cal	1.68	0.25	0.86	2.95		0.00	0.00	0,00	0.02	0.38	9.73		
Ogden City, Utah	2.12	2, 62	0,00	4, 12	0.95		0.00	0.51	0.52	0.47	3.63		19, 43
Orland, Cal	1.34	0.58	0.05		0.82		0.00		0.22	0.00	9.41		16.66
Pajaro, Cal Palisade, Nev		0.15	0.22	0.96			0.13		0.05	0.00	7, 91		15, 33
Palisade, Nev	1.00	0, 61	0.00	1.09		1.06	0.00	0.25	0, 20	0.10	1.88	0.60	7.68
Pantano, Ariz	0.00	1.10	0.78	0.05					2.08			0.56	8, 96
Petaluma, Cal	1, 34	0.76					0,00		(2)		11. 33		
Pantano, Ariz Petaluma, Cal Pleasanton, Cal Promontory, Utah Ravenna, Cal Red Bluff, Cal	1.78	0. 22	1.14				0.00	(2)	0.00	(2)	7. 33		0.00
Payenna Cal	0.32	0.00	0, 15	1.32 0.92	0, 10	0.00	0,00	0.00	0.10	0.00	1.45 5,20	0.80	8, 85 7, 70
Rad Bluff Cal	1. 85	1.50	0.00			1.42		0.00	2, 50	0. 20	17, 22	4 25	30, 51
Redding, Cal	2.32	1. 28		3. 63	0.00	(2)	(2)	0.00	(1)		11.90		
Rono Nev	(2)	0.00			0.00	0.00		0.00	0.00	0. 00	1, 55	0. 60	
Rocklin, Cal	1, 36	0.40		0.82	0. 11	0.18	0.00	0.00	0.03	0.00	(2)	3, 96	
Sacramento, Cal	1.89	0.43		0.53	0.00	0.10	0.00	0.00	0.07	0.00	8, 58		17, 11
Salinas, Cal	1.07	0.00	0. 19	1, 36	0.15	0.00	0.09	0.00	0.00		6, 37		10.48
Salinas, CalSan Fernando, Cal	0, 90	0.00		1.48			0.00	0.00	0.00		7.94		11.69
San José, Cal San Mateo, Cal	1.83	0.18		2, 75	0.11	(1)	0.00	0, 00	0.00		7.39	2, 11	15, 29
San Mateo, Cal	2.36	0. 19		4. 20	0, 05	0, 10		0.00	0.02		6.88		16.79
San Simon, Ariz	0.11	0.05		0.00	0. 10	0.01	0.07	0.50	(2)	(2)	(2)	(2)	30.07
Santa Cruz, Cal Santa Monica, Cal	2 11 (2)	0.41 (2)	0.47	2.43 0.58	0.05	0.00	0.08	0.00	0.07	0.10		(1)	18, 87
	0.92	0.00		(3)	0.00	0.00	0.00	0.00	0.00	0. 20		1.02	*****
Soicala, Cai Soguel, Cai Sonth Vallejo, Cai Spadra, Cai Stockton, Cai Suisun City, Cai Summit, Cai	(2)	(2)	(2)	(2)	(2)	(2)	0.00	0.00	0.00	0.00	(3)	(2)	
South Valleio Cal	1.75	0. 26			0.00	0.00	0.00	0.00	0.00	0.50	7.87		16.77
Spadra Cal	0.00	(2)		1.58	0.22	0.00	0.00	0.12	0.00	0.90		0.90	
Stockton, Cal	1. 11		0.23	0.95	0.00	0.00	(2)	0.00	0.00	0.00	(2)	0.74	
Suisun City, Cal	1.06	1. 25		1. 52	0.02	(1)	0, 00	0.00	0.05	0. 22		4.43	
Summit, Cal	1.40	0.58		4.88	1.00	(2)	0.00	(2)	0.05	0.00		3.00	
Sumner, Cal	0,00	0.02			0.05	0.00	0.05	0.00	0.00	0.03			7.17
Summer, Cal Tecoma, Nev Tehama, Cal Tehachapi, Cal	0.55	0. 25		0.98	0, 80	0.50	0,00	0.20	0, 20	0.00			4.98
Tehama, Cal	1. 67	0.60			0.73	0.72	0.00	0.00	0.48	(,)	10.42	3, 00	18. 37
Tenachapi, Gai	0.10	0.00		1.48	0.30	0.00	0.05	0.31	0.00	0.00	(2)	0.52	
Tennant, Cal Terrace, Utah	0.08	0. 16	(1)	0, 27	1.12	0.53	0.00	0.02	0. 25	(1)	(2)	0.03	
Texas Hill, Ariz	0,00	0. 04		0.00	0.00	0.00	0.00	2, 25	0. 00	0.00	(2)		
Toano, Nev	1, 00	0.70		1.34	2.49	1. 44	0.00	(2)	0, 35	0.03		0.67	
Towles, Cal	(2)	(2)	(2)	(5)	(2)	(2)	0.00	0.00	0.80	0. 00		7.00	
Fracy, Cal	0, 93	0, 10	0. 10			0.00	0.00	0.00	0.00	0.00		0.85	7, 95
Truckee, Cal	1, 80	0.54	0.56	2.04	0.08	0.00	0.00	(4)	0.47	0.00	6, 95	2, 22	
Tucson, Ariz	0, 00	0.48			0.00	0.07	0.12	0.32	0.00	0.00	0, 10	0.90	2, 20
Fulare, Cal	0, 28	0.00		1.44	0.13	0.00	0.05	0.00	0.00	0.00	3.36	1.48	7.66
Turlock, Cal	1.22	0.00			0.00	0.00	0.00	0.00	(1)	0.00	6.63		10, 41
Wadsworth, Nev	0.40	0. 03			(3)	0. 54	0.00	0.08	0.05	0.00	1, 13	0.49	
Wells, Nov	0.85	0.95	(1)	1. 56	1, 92	1. 47	0. 27	3.00	0. 24	0.18	1.10	(2) (2)	
Willcox, Ariz	0.66	0.59	0.15	0.00	0.00	0.89	0.00	0.00	0.80	0.70	0.42		
Williams, Cal	1, 28	0.53		0. 94	0. 20	(3)	0.00	0.00	0. 30	0. 70	7. 28	9 32	
Winnemucca, Nev	0. 66	0.41			1. 19	2.37	0,00	0.04	0. 08	0. 07	3.78	(3)	
Woodland, Cal	1.43	0. 12			0.00	0.00	0.00	0.00	0.00	0, 20	(2)	3.75	
Yuma, Ariz			0.00			0.00	(2)	(2)	0.00	0.00	(2)	0.00	

¹ Inappreciable.

² No record.

⁸ Discontinued November 1, 1885.

# APPENDIX 45.

Precipitation at the cotton-region stations of the Signal Service, United States Army, for the months May to October, 1885, both inclusive.

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Districts and stations.	May.	June.	July.	August.	September.	October.
Wilmington, N. C.:	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.
Charlotte, S. C.	5, 53	8.48	6. 31	3, 18	3.45	1 NCAES.
Cheraw. S. C	6.48	4.98	4.98	2. 69	1.90	6. 28
Florence, S. C	4.71	5. 64	3. 99	7. 22	3. 37	4.39
Lumberton N C	5. 87 6. 46	5.31 7.67	5, 25 7, 34	4. 67 3. 02	2.70 3.69	3. 20 4. 04
Fiorence, S. C. Goldsborough, N. C. Lumberton, N. C. New-Berne, N. C. Italeigh, N. C. Salisbury, N. C. Veldon, N. C. Weldon, N. C. Willengton, N. C. Willengton, N. C.	10.86	5. 17	5.53	5.94	3.00	2.41
Raleigh, N. C	7.00	0. 99	2.02	5.77	2.42	4.00
Salisbury, N. C	6. 35	8. 60	3. 35	3. 28	2.54.	5.49
Walden N C	8. 97 8. 59	1. 73 1. 85	2. 61 5. 21	1.82 1.35	1. 93 2. 25	3.21
Wilmington, N. C	8.58	8. 20	4.04	4.73	5.69	(¹) 8.73
(the market To Co.	1			1		۵.۰
Branchville, S. C. Charleston, S. C. Hardeeville, S. C. Jacksonborough, S. C.	1.03	5.47	3.00	7.24	2.36	3.18
Charleston, S. C	2, 20 4, 73	5.96 12.95	7.49 7.83	19. 18 17. 01	3. 32 5. 89	8.09
Jacksonhorough, S. C.	3.08	5.95	8.68	10.71	2.63	6.10 4.29
Kingstree, S. C.	5. 86	5.64	5.74	10.19		(4)
Kingstree, S. C. Saint George's, S. C. Saint Matthew's, S. C.	3, 73	4. 85	4.47	6. 33	(¹) 2, 58	3.79
Yemassee, S. C	4.51 5.67	5.57	8.83 8.74	5. 75	2. 15	4.56
Augusta, Ga.:	0.07	6. 20	8.74	14.72	7. 37	3. 80
Allendale, S. C	5.77	4. 12	6.49	4. 58	5. 24	3.85
Athens. Ga	6.95	4.01	5.01	7.61	8.06	5. 07
Augusta, Ga. Batesburg, S. C.	5.87	2.80	8. 57	3.50	2.72	4. 18
Blackville, S. C	4.59 2.64	5. 29 7. 20	3.45 4.46	3. 23 5. 85	4. 28 3. 92	6. 14 3. 90
Camak Ga	R.M	5, 22	2.63	3,48	7. 35	5. 27
Chester, S. C. Columbia, S. C. Greenwood, S. C.	1.71	2.46	5. 23	3.84	2. 55	5. 50
. Columbia, S.C	9. 21	4.90	5. 04	2.86	2.47	4. 02
Union Point, Ga	4.09 8.65	4.18 2.47	2.86 3.86	5. 13 4. 29	3. 69 6. 43	5. 59 6. 32
Washington Ga	8.43	4. 83	1.18	3. 54	5. 27	4.90
Washington, Ga Waynesborough, Ga	4.79	8.49	1.83	3. 83	3.63	4. 15
Savannah, Ga.:	l .		l			
Albany, Ga Allapaha, Ga	5. 07 4. 09	3. 32 1. 74	9.09 5.38	5. 61 7. 90	3.85 6.95	2. 45 3. 75
Bainbridge, Ga	0.44	0. 31	0.73	0.95	2.45	a ii
Coder Kave Kla	2 42	10.98	9, 17	10.09	5.76	4.38
Eastman, Ga	0.19	0.15	0.42	2.80	7. 96	4.45
Fernandina, FlaFort Gaines, Ga	5. 21 8. 21	3.97 2.21	7. 62 3. 88	7.47 5.41	13. 16 5. 12	5. 26 2. 96
Jesenn Ga	8.48	8.00	7.41	11.68	12.52	10.02
Live Oak, Fla	5. 58	6.97	5.51	9. 71	11.18	8. 35
Millen. Ga	3.12	4.86	5. 56	6.87	3, 98	3, 39
Quitman, Ga	4.59	1.66	3. 37 7. 30	2.04 14.95	4. 10 11. 96	2.07
Savannah, Ga Smithville, Ga	3.98 4.64	8.10 2.38	4.04	4.99	3.61	0.88
Thomasville, Ga	8.08	6.15	4.60	8, 19	6.69	2.66
Waldo, Fla	6, 30	1.89	1.23	3.15	4.52	0.14
Way Cross, Ga	5. 15	4. 35	7. 55	8.89	16.13	3. 60
Atlanta, Ga.: Anderson, S. C	2.35	8.74	3.45	4.48	5.12	5.32
Atlanta Ga	6.21	4.83	4.02	6.92	6.50	3.95
Cartersville, Ga	6.08	3. 61	3.42	5. 62	4.37	4.03
Columbus, Ga	6.01	3.83	3.66	6.64	6.25	5.62
Daltou, Ga	7. 25	6.16	1.58	3.70 5.05	8.74	8. 93
Greenville, S. C.	4.04	2.81 4.87	5.06 3.75	6.39	6.73 8.97	4.58 6.78

1 No record.

### Precipitation at the cotton-region stations of the Signal Service, &c.--Continued.

Districts and stations.	May.	June.	July.	August.	September.	Ootober.
tlanta, Ga.—Continued:	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.
Macon. (ia	5.18	3. 35	0.46	3.03	8.05	3.78
Newnan, Ga	6.60 4.83	3. 29 3. 99	5. <b>62</b> 3. 81	6. 95 2. 79	8.08 2.42	5.86 5.53
Tocooa. Ga	8. 01	1.75	2. 29	4. 19	6.29	8.38
West Point, Ga	4.59	5. 83	2.02	7.76	8.81	5.97
floutgomery, Ala.: Birmingham, Ala	6.48	3.49	3.96	3. 31	6, 97	2, 33
Calera Ala	5, 21	4.40	4.05	2.52	5.65	1.26
Eufaula, Ala Fort Deposit, Ala	3.02	1.96	4.50	4.71	6.06	1.85
Greenville, Ala	5. 08 14. 45	2. 90 9. 16	3. 10 2. 17	3. 99 3. 54	4.35 3.39	2.87 1.70
Marion, Ala	3, 03	1.07	4.47	4.56	2.57	(1)
Montgomery Ala	8 92	4. 32	7.54	3.93	4.83	2.38
Opelika, Ala	7.13 3.95	3. 33 2. 83	6. 98 0. 92	3.75 3.24	6. 43 2. 88	4.56
Opel ka, Ala Pine Apple, Ala Selma, Ala	2.64	1.23	5.75	1.95	0. 25	0.30
Hobile, Ala.:	t	1	}		ł.	ł
Aberdeeu, Miss		2.44	2.80	2.56	6.83	2.87
Columbus, Miss	6.44	4.30	4, 59 (2)	2.36 4.35	6.97	2.82
Evergreen, Ala Livingston, Ala	(1) 3.68	6	0.25	2.74	3.52	3. 3
Macon, Miss	7.31	0.15	3.39	1.93	6.49	3.11
Meridian, Miss		(¹) 4.15	0. 23 3. 81	0. 18 6. 07	0.31 9.25	0.02
Okolona Miss	5 93	2.50	1.01	2.02	8.46	2. 2
Waynesborough, Miss	8, 13	2.50	7. 30	8.75	4.99	1.5
New Orleans, La.: Alexandria, La	1	2.56	4	0.04	4.34	
Amito City, La	3, 56 0, 09	0.11	4. 27 0. 20	2. 94 0. 06	0.07	1.3
Brookhaven, Miss	0.84	4.07	6. 99	4.62	5.93	1.7
Chenovville, La	2.88	3.62	2.62	5.40	8.91	0.0
Coushatta Chute, La	2, 86 0, 11	3. 82 0. 37	0.46	3. 21	4. 26 1. 23	2. 2
Lafayette, La	5. 84	4.11	7.37	0. 30 6. 76	7.70	0.1
Mindon To	0) 41	2.70	4.80	1.51	3.75	2. 0
Natchez, Miss Natchitoches, La	3. 52	1.89	5.36	8.85	2.77	1.0
		2. 38 3. 30	8. 57 6. 15	2. 52 4. 25	6. 25 13. 55	1.5- 0.5-
Oneleneus Té	4.77	4.22	2.43	5.71	4.84	0.1
Port (-ihaon Miss	1 /1)	(*) 5.77	1.83	2.53	6.01	1.0
Shreveport, La	8.70	5.77	. 4.80	0. 91	6.70	4.1
Galveston, Tex.: Austin, Tex Belton, Tex	(1)	0.37	3. 19	1. 31	4.78	1.3
Belton, Tex	2.97	0.08	0. 11	0.41	2. 59	0.1
Brenham, Tex Columbia, Tex	(¹) 5, 20	0.57	2,02	(¹) 2.06	2. 24 9. 06	1.4
Coreicene Tay	5 04	3.36	2.35	0.44	2.49	2.4
Cuero, Tex	4.03	0.30	5. 37	3.48	3.43	1.2
Dallas, Tex	6.99	9.69	2.26	1.85 1.74	0.74	0.7
Galveston, Tex	6.41 9.54	3, 26 0, 00	2.20 2.70	0.40	26.01 9.16	2. 2
Honeton Tex	4 65	2.43	3.88	1.48	4.65	1.4
lluntsville, Tex Longview, Tex	6. 33	0.71	8. 10	8.02	5.37	0. 9
Luling, Tex	4.92	5. 86 0. 00	5. 62 0. 00	0. 12 0. 15	6.08	10.2
Orange, Tex	(4)	0.10	0.39	7.00	0.53	0.3
Palestine, Tex San Antonio, Tex	6.08	2.07	(²) 6.56	1.87	4.63	1.4
San Antonio, Tex	² 6.79	0.86		0.95	1.51	0.6
Sour Lake, Tex	43. 10 2. 08	5.06 1.24	1.16	4.20	9. 11 2. 85	(²) 0.5
Waco, Tex	12.44	2. 22	2,47	0.73	6. 85	0.5
Weatherford, Tex	7.50	4. 23	1.00	2.50	2.75	1.9
Weimar, Tex Vicksburg, Miss. :	10.43	0.18	5. 68	0.10	3. 12	2.0
Edwards, Miss	2.59	0.81	4.05	1.54	12, 15	1.1
Jackson, Miss	2, 39	1.71	4.00	1.00	10.32	1.4
Lake, Miss	3.86			1.10 4.85	3. 90 6. 51	1.6 0.8
Monroe, La	3.43 4.75			1.04	9. 28	1.0
Little Rock Ark	ŀ		1	ı	ł	1
Arkansas City, Ark Brinkley, Ark Devall's Bluff, Ark	(')	(²)	1.39	2.77	7.31	0.2
Dovall's Rinff Ark	0.90 4.23	1.62 2.71	1.20 2.00	1.00		0.0 1.5
AUTOM O DIUM, ALA	2.50	4. 88		2. 99		
Fort Smith, Ark	2.00	7.00	1.21	1.00		1.3

Precipitation at the cotton-region stations of the Signal Service, &c.—Continued.

Districts and stations.	May.	June.	July.	August.	September.	October.
Little Rock, Ark.—Continued:	Inches.	Inches.	Inches.	Inches	Inches.	Inches.
Kensett Ark	11.24	3, 96	0.97	0. 39	1.45	1,10
Little Rock, Ark	3. 26	3.89	1.18	1.95	2.06	1.03
Madison, Ark	1.60	1.30	2. 12	0.02	0.29	0.05
Magnolia, Ark		5.74	3.50	2.81	0.50	2.63
Malvern, Ark	6. 11	3.67	1.02	1.83	2.05	0.80
Monticello, Ark		3.55	3.48	2. 28	2.93	1.10
Newport, Ark	1.09	2.08	3.36	0. 32	1.12	9.87
Paris, Tex		2.34	3.12	2. 32	3.95	1.91
Pine Bluff, Ark		2.45	2.46	0.41	(4)	(1)
Prescott, Ark		1.17	0.90	0.04	0.27	0.13
Russellville, Ark		2.95	0.85	1. 20	3.87	0.35
Texarkana, Ark	(²)	4.03	2.18	2. 23	2.02	2.60
Momphis, Tenn.:		i				
Arlington, Tenn	0.15	0.30	0.19	0.14	0. 29	0.04
Batesville, Miss		3.06	3.00	1.43	6.86	0.20
Bolivar, Tenn	2.40	5.95	2.00	0.85	5.16	1.20
Brownsville, Tenn	1.07	9, 75	3.29	1.02	2.61	2.00
Corinth, Miss	0. 33	0. 38	0.31	0.01	0.08	<u>ල</u>
Covington, Tenn		4.75	2. 15	1.10	1.64	L.73
Decatur, Ala		4.76	3.79	3.74	3. 25	3.00
Dyersburg, Tenn		7. 12	4.59	1.04	2.94	1.74
Grand Junction, Tenn		6. 56	4.47	0.66	6.80	1.68
Grenada, Miss		1.95	1.23	1.51	4.08	(2)
Hernando, Miss	0.60	4.03	3. 37	1.65	5. 58	1.64
Holly Springs, Miss		4.60	2. 35	1.46	6.80	2.47
Memphis, Tenn	3.05	1.52	4.80	1.70	4.40	0.93
Milan, Tenn	3.17	5. 19	3, 79	0.56	2.63	3.79
Nashville, Tenn	4. 32	3.70	5. 19	0.96	5.49	3.01
Oxford, Miss		6, 68 5, 25	1.33 2.16	1. 25	5.45 2.18	0.75 2.24
Paris, Tenn.	2.99	5. 25 5. 93	2. 16 6. 40	3.48	4.07	57
Scottsborough, Ala	7.45	0.63	1. 22	2.64	7.87	2.03
Tuscumbia, Ala	3. 54	0.03	1.23	2.04	1.67	2.03

For 24 days.

²No record.

APPENDIX 46.

Monthly maximum and minimum temperatures (in degrees Fahrenheit), and the precipitation, at third order stations of the Signal Service, United States
Army, for the year 1885.

	ר	January.		Fe	February.			March.		•	April.			May.		Ĭ	June.	
	Temp	Temperature.	·u	Temperature	rature.	TE	Temperature	rature.	i	Temperature	ature.	<u> </u>	Temperature	stare.	·u	Temperature	sture.	·u
סייינים מו נחום מנתני	Maximum.	.mominiM	Precipitatio	.anaixeM	.anomiaiM	Precipitatio	.anaizaM	Minimum.	Precipitatio	.analzaM	.momfaiM	Precipitatio	.mnmixaM	Minimum	Precipitatio	.mnmixaM	.arominiM	Precipitatio
Taking one observation daily at sunset:	۰ %	0 61	15 TH	۰ ۾	° ដូ	¥.3	0 2	۰ జ	In. 0.01	۰ 🕏	s o	I. 63	• 2	۰ ي	7. 8. 74.	• &	• 8	15 %
Astoria, Oreg.	32	187	6. 53 8. 53	3.2	<b>2</b> 3	1.81		22	1.51 2.15	<b>≍</b> 8	នន	4.0 88	58	34	8 3 3 3	583	ý z s	28 S
Control of Alene, Fort, Idaho	848	-22.5	3.43	22	22	234	22	25		73	នះ	88	 E%8	೦೫ ಕ	. 50°	8 <b>2</b> 8	2 2 2 3 3 3 8	
Lakeview, Oreg.	5. 8 2. 8	- œ -	386	3E	:0g	<u></u>	888	385		:23	9 5	884	888	20.00	348	30 <u>5</u>	10.A	
Linkville, Oreg.	52	55.55	22.5	55	2.8	1.33	22			55	17.8	86	182		888		£	€,
Maricopa, Ariz McDowell Fort, Ariz	55	24.7	88	2,5	22.5	25.	88	28.5			22	88	111	50.5 50.5	88	100	22	 28
Mission, Alaska, Narragansett Pier, R. I.	39 57	ر د د د د د د د د د د د د د د د د د د د	0. c. 3.55	8.9	2 g	0.40 1.75	32	18 to		25	75	2.6	28		8 42 45	€≋	Đạ	€.:
Neah Bay, Wash	\$ 2	27 16.4	3.61 8.61	8 53 60	2.5 2.5	8. 5. 8. 5.	3 3.	22 9.0		82	81 82,2	2.5 2.5	88 75.9	89.3 30.3	5.70	೯೯	<b>\$</b> £	30
Omilak, Alaska Phomix, Aria	585 1	227	888	€ €	22.	8.0°	೯೩೪	*****		<b>E</b> 84	+8; 28,4 18,4	888	527	€ <u>7</u> 8	S. 5	€8. 8.	€ 8 8	25 25-
Pysht, Wash Rene Fort Ind T		24.5	14.32	288	80	284				358	283	358	328		88		:≋€	. 4 d
San Carlos Agency, Ariz Spokane, Fort, Wash	86. <del>7</del>	.i.e	0.0	8.23	- 8 - 0	83	25.55 80	#2 *		88	€8	85	22.4	€≋	222	2.8	87.2 20.2	 28
Supply, Fort, Ind. T. Ugashik, Alaska	2,2	1 13.5	82	52		0.0	28	======================================		22	28.2	8. 7. 7.	28	22	7.58	9 <del>1</del> .5	2 2 2	۲.4 48
Verde, Fort, Ariz.	2,8 2,8	12.5	88 88	78.5	ដដ	6.5	83	88		82	8 8 9 9 9 5	0 4 8 5	88		0.4 0.15	8.2 8.0		0.00 85
Wickenburg, Ariz Willox, Ariz. Yates, Fort, Dak	858 8	828 	6.00 8.00 8.00	5 <b>5 8</b>	25.2	988	\$ 22 E	788	9:-9 884	 380	ភ្នំដ វិង១	385	88.5 25.5	125 200	gee gee	3.5 5.5	\$3£	8 <b>%</b> 565

Monthly maximum and minimum temperatures (in degrees Fahrenheit), and the pr. cipitation, at third order stations of the Signal Service, United States Army, for the year 1885—Continued.	ralures	: : :	rees 1	ahren my, foi	teil), a . the ye	nd th	S P. C	e Fahrenheil), and the pr. cipitation, Army, for the year 1885—Continued	, at 8d.	third o	order s	tation	s of th	s Signe	al Ser	riœ, Un	ited St	ates
		January.		Ă	February.			March.			April.			May.		7	June.	[
Seat 14 % of and Seat Seat Seat Seat Seat Seat Seat Seat	Temp	Temperature.	·ac	Temperature	rature.	i	Temperature.	rature.		Temperature.	rature.	·u	Тепрегасиге.	ature.	1	Temperature.	ture	706
1910 1910 190	.momizaM	-analaiM	Precipitatio	.concolxaM	Minimum	Precipitatio	.mumizaM	.wwalaiM	Precipitatio	.canquixeM	.momlai <b>M</b>	Precipitatio	mamixaM	Minimum.	oitatiqiaerq	.msmixaM	.aramini <b>M</b>	Precipitatio
Taking two observations daily at 3 and 11 p. m., 76th meridian time: Anvik, Alaska Akta, Alaska Hoochnoho, Alaska Komai, Alaska Koskokrim, Alaska Pyramid Harbor, Alaska Tcha-tow-klin, Alaska	- £83€€\$\$	° 87.48€€8	78. 10. 33. 10. 33. 10. 33. 10. 68. 0. 68. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0. 28. 0	。ä±4€€#\$	o 2 2 0 1 0 € 3	20.00.00.00.00.00.00.00.00.00.00.00.00.0	• ##€€€£%	° ##€##€\$	11.77 1.76 1.05 1.05 1.05	• ಸೆಕೆಲಲನಔಷ	ಿ - ನ್ನಲ್ಲಿ ಇಲ್ಲ	1.30 0.71 0.71 0.71 0.92	∘ <b>ಇ</b> €೯೯೯೯	° #202000	4 <u>2</u> 00000	• 55855%5	• 5542555	In. 0.49
Observations discontinued October 31, 1865.	Octobe May 17,	r 81, 186 1885.	- i		_		Inappr No rec	*Inappreciable.				1	Record incomplete.	incomi	lete.	-		1

Monthly maximum and minimum temperatures (in degrees Fahrenheit), and the precipitation, at third order stations of the Signal Sertice, United States Army, for the year 1885—Continued.

Shellong of the third order.   Temperature			July.		4	August.		8	september.		3	October.		9	November.			December.	
minimization		Tempe	rature.	i	Temper	ature.	i	Cemper	ature.	٠	Гешрег	ature.	Ī	Temper	ature.		emper	sture.	ים
Continuent   Con	of the third order.	Maximum	<b>A</b> mmiaiM	Procipitatio	.anantzaM	Minimam.	oltatiqiser 1	.mumixaM	-mominiM	oitatiqiserq	.mumizaM	Minimum.	Precipitatio	.mnmixaM	.momiaild	olistiqiserT 	.momizsM	.mpmlniM	olisilqisər
88         51         0.04         74         51         0.04         74         61         4.24         75         42         75         42         75         42         75         42         75         42         75         42         75         42         75         71         14         75         75         75         75         75         75         75         75         75         75         75         75         75         75         75         75         75         75         75         75         75         75         75         75         75         75         75         75         75         75         75         75         75         75         75         75         75         75         75         75         75         75         75         75         75         75         75         75         75         75         75         75         75         75         75         75         75         75         75         75         75         75         75         75         75         75         75         75         75         75         75         75         75         75         75         <	: حد ا	108	013	In. 0.02	0 8	<u> </u>	<u> </u>	• &	<u> </u>	I. 18	۰ 8	93 °	1,53	۰ ۾	i —	In. 8,02	• ခွ	<del></del> -	In. 3.32
68         54,5         3.40         98.1         43.5         1.26         77.5         2.06         72.5         22.1         4.05         64.1         17.5         3.70         17.5         2.06         72.5         22.1         4.05         64.1         17.5         3.70         4.0         4.0         4.0         6.0         6.0         6.0         6.0         6.0         6.0         6.0         6.0         6.0         6.0         6.0         6.0         6.0         6.0         6.0         6.0         6.0         6.0         6.0         6.0         6.0         6.0         6.0         6.0         6.0         6.0         6.0         6.0         6.0         6.0         6.0         6.0         6.0         6.0         6.0         6.0         6.0         6.0         6.0         6.0         6.0         6.0         6.0         6.0         6.0         6.0         6.0         6.0         6.0         6.0         6.0         6.0         6.0         6.0         6.0         6.0         6.0         6.0         6.0         6.0         6.0         6.0         6.0         6.0         6.0         6.0         6.0         6.0         6.0         6.0         6.0	eg Aris	102	128	5.6	₹8			28		4.24	5.8	25	40	22		35	35		9.65
10. 10. 10. 10. 10. 10. 10. 10. 10. 10.	open, Del.	86	54.5	300		2		1.1	-	1.26	328		388	128	-	.63	67.1		. 20
107.8 66 0.25 101 46.2 0.43 86 31 0.02 95.2 27 0.82 71 5.5 0.57 65.5 5.5 15.5  107.8 66 0.00 83 44 0.00 82 44.0 0.00 82.5 0.40 86.5 27 0.02 80 19.8 0.02 60.2 10.2 13.5  107.8 66 0.00 83 44 0.00 82 108.5 10.00 82 2.5 (4) (4) (4) (5) (2) (2) (2) (2) (2) (2) (2) (2) (2) (2	Fort, Oreg	35	282	38	 g€					1.89	33	31=	55	38		7.20			* S
956 466 6.00 83 444 6.00 82 32.5 (4) (4) (4) 10.0 83 23 8.70 8.70 113.4 6.0 83 8.50 113.4 6.0 83 8.50 113.4 6.0 83 8.50 113.4 6.0 83 8.50 113.4 6.0 83 8.50 113.4 6.0 83 8.50 113.4 6.0 83 8.50 113.4 6.0 83 8.50 113.4 6.0 83 8.50 113.4 6.0 83 8.50 113.4 6.0 83 8.50 113.4 6.0 83 8.50 113.4 6.0 83 8.50 113.4 6.0 83 8.50 113.4 6.0 83 8.50 113.4 6.0 83 8.50 113.4 6.0 83 8.50 113.4 6.0 83 8.50 113.4 6.0 83 8.50 113.4 6.0 83 8.50 113.4 6.0 83 8.50 113.4 6.0 83 8.50 113.4 6.0 83 8.50 113.4 6.0 83 8.50 113.4 6.0 83 8.50 113.4 6.0 83 8.50 113.4 6.0 83 8.50 113.4 6.0 83 8.50 113.4 6.0 83 8.50 113.4 6.0 83 8.50 113.4 6.0 83 8.50 113.4 6.0 83 8.50 113.4 6.0 83 8.50 113.4 6.0 83 8.50 113.4 6.0 83 8.50 113.4 6.0 83 8.50 113.4 6.0 83 8.50 113.4 6.0 83 8.50 113.4 6.0 83 8.50 113.4 6.0 83 8.50 113.4 6.0 83 8.50 113.4 6.0 83 8.50 113.4 6.0 83 8.50 113.4 6.0 83 8.50 113.4 6.0 83 8.50 113.4 6.0 83 8.50 113.4 6.0 83 8.50 113.4 6.0 83 8.50 113.4 6.0 83 8.50 113.4 6.0 83 8.50 113.4 6.0 83 8.50 113.4 6.0 83 8.50 113.4 6.0 83 8.50 113.4 6.0 83 8.50 113.4 6.0 83 8.50 113.4 6.0 83 8.50 113.4 6.0 83 8.50 113.4 6.0 83 8.50 113.4 6.0 83 8.50 113.4 6.0 83 8.50 113.4 6.0 83 8.50 113.4 6.0 83 8.50 113.4 6.0 83 8.50 113.4 6.0 83 8.50 113.4 6.0 83 8.50 113.4 6.0 83 8.50 113.4 6.0 83 8.50 113.4 6.0 83 8.50 113.4 6.0 83 8.50 113.4 6.0 83 8.50 113.4 6.0 83 8.50 113.4 6.0 83 8.50 113.4 6.0 83 8.50 113.4 6.0 83 8.50 113.4 6.0 83 8.50 113.4 6.0 83 8.50 113.4 6.0 83 8.50 113.4 6.0 83 8.50 113.4 6.0 83 8.50 113.4 6.0 83 8.50 113.4 6.0 83 8.50 113.4 6.0 83 8.50 113.4 6.0 83 8.50 113.4 6.0 83 8.50 113.4 6.0 83 8.50 113.4 6.0 83 8.50 113.4 6.0 83 8.50 113.4 6.0 83 8.50 113.4 6.0 8.50 113.4 6.0 8.50 113.4 6.0 8.50 113.4 6.0 8.50 113.4 6.0 8.50 113.4 6.0 8.50 113.4 6.0 8.50 113.4 6.0 8.50 113.4 6.0 8.50 113.4 6.0 8.50 113.4 6.0 8.50 113.4 6.0 8.50 113.4 6.0 8.50 113.4 6.0 8.50 113.4 6.0 8.50 113.4 6.0 8.50 113.4 6.0 8.50 113.4 6.0 8.50 113.4 6.0 8.50 113.4 6.0 8.50 113.4 6.0 8.50 113.4 6.0 8.50 113.4 6.0 8.50 113.4 6.0 8.50 113.4 6.0 8.50 113.4 6.0 8.50 113.4	Oreg	107.8	 	2.25	101	~	55			0.0 8.0 8.0	85.85 61.75	32	88	== ==	بر م	6.57 0.20			2.15
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94. 3 60. 65	laska	<b>:</b>	E	3€			-		•	88	3		22	38		20:			0.95
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113.4 46.2 0.18 114.0 48.9 0.71 112.7 43.0 0.07 104.8 89.7 0.09 96.2 81.2 0.91 89.2 20.2 0.32 88.7 113.4 46.2 0.18 114.0 48.9 0.71 112.7 43.0 0.07 104.8 89.7 0.09 96.2 81.2 0.91 89.2 20.2 0.32 88.7 113.8 69.8 1.28 113.1 84.3 28.6 1.48 71.6 (*) 2.09 88.4 113.1 84.3 28.6 1.48 71.6 (*) 2.09 88.4 113.1 84.3 28.6 1.48 71.6 (*) 2.09 88.4 113.1 84.3 28.6 1.48 71.6 (*) 2.09 88.4 113.1 84.3 28.6 1.48 71.6 (*) 2.09 88.4 113.1 84.3 28.6 1.48 71.6 (*) 2.09 88.4 113.1 84.3 28.6 1.48 71.6 (*) 2.09 88.4 113.1 84.3 28.6 1.48 71.6 (*) 2.09 88.4 113.1 84.3 28.6 1.48 71.6 (*) 2.09 88.4 113.1 84.3 28.6 1.48 71.6 (*) 2.09 88.4 113.1 84.3 28.6 1.48 71.6 (*) 2.09 88.4 113.1 84.3 28.6 1.48 71.6 (*) 2.09 88.4 113.1 84.4 20.5 1.00 89.4 113.1 84.3 28.6 1.48 71.6 (*) 2.09 88.4 113.1 84.4 20.5 1.00 89.4 113.1 84.4 20.5 1.00 89.4 113.1 84.4 20.5 1.00 89.4 113.1 84.4 20.5 1.00 89.4 113.1 84.4 20.5 1.00 89.4 113.1 84.4 20.5 1.00 89.4 113.1 84.4 20.5 1.00 89.4 113.1 84.4 20.5 1.00 89.4 113.1 84.4 20.5 1.00 89.4 113.1 84.4 20.5 1.00 89.4 113.1 84.4 20.5 1.00 89.4 113.1 84.4 20.5 1.00 89.4 113.1 84.4 20.5 1.00 89.4 113.1 84.4 20.5 1.00 89.4 113.1 84.4 20.5 1.00 89.4 113.1 84.4 20.5 1.00 89.4 113.1 84.4 20.5 1.00 89.4 113.1 84.4 20.5 1.00 89.4 113.1 84.4 20.5 1.00 89.4 113.1 84.4 20.5 1.00 89.4 113.1 84.4 20.5 1.00 89.4 113.1 84.4 20.5 1.00 89.4 113.1 84.4 20.5 1.00 89.4 113.1 84.4 20.5 1.00 89.4 113.1 84.4 20.5 1.00 89.4 113.1 84.4 20.5 1.00 89.4 113.1 84.4 20.5 1.00 89.4 113.1 84.4 20.5 1.00 89.4 113.1 84.4 20.5 1.00 89.4 113.1 84.5 1.00 89.4 113.1 84.5 1.00 89.4 113.1 84.5 1.00 89.4 113.1 84.5 1.00 89.4 113.1 84.5 1.00 89.4 113.1 84.5 1.00 89.4 113.1 84.5 1.00 89.4 113.1 84.5 1.00 89.4 113.1 84.5 1.00 89.4 113.1 84.5 1.00 89.4 113.1 84.5 1.00 89.4 113.1 84.5 1.00 89.4 113.1 84.5 1.00 89.4 113.1 84.5 1.00 89.4 113.1 84.5 1.00 89.4 113.1 84.5 1.00 89.4 113.1 84.5 1.00 89.4 113.1 84.5 1.00 89.4 113.1 84.5 1.00 89.4 113.1 84.5 1.00 89.4 113.1 84.5 1.00 89.4 113.1 84.5 1.00 89.4 113.1 84.5 1.00 89.4 113.1 84.5 1.00 89.4 113.1 84.5 1.00 89.4 113.1 8	Md	94.3	60.5	1.27	<b>8</b> 8.4	8		2.4 1.4	-	.83	74.7	8:3	5.3 5.3			4.56	3.5		4.40
(b)         (c)         (d)         (d) <td>riz</td> <td>113.4</td> <td>6.2</td> <td>0.18</td> <td>114.9</td> <td>_</td> <td></td> <td>112,7</td> <td>0</td> <td>0.0</td> <td>104,8</td> <td>89.7</td> <td>8</td> <td></td> <td>61</td> <td>0.0</td> <td>89.3</td> <td>20.5</td> <td>.32</td>	riz	113.4	6.2	0.18	114.9	_		112,7	0	0.0	104,8	89.7	8		61	0.0	89.3	20.5	.32
11.8   60.8   1.58   1.58   68.4   55   8.74   95.4   50.2   8.62   88.1   1.31   84.3   28.6   1.45   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71.6   71	ith, B. L	£	€;	೯	e:			€;		€	8,6 2,4	5,52	20 E	- 12		:		÷	
11.8   50.8   1.25   110.3   63.   1.22   10.18   49.   0.84   91.1   22.6   0.34   60.4   20.7   0.70   60.4   17   0.00   63.	, Ind. T	98.0	:€	1.8	4.5			95.4	61	3.62	88	28.	1.35			2	71.5		
10   10   10   10   10   10   10   10	Agency, Aria	3.5	8.63	88	110.3	_	_	8.10	_	<b>3</b> ;	9.1	25. G	78.0 0.3	86		2	<b>9</b> :		
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186 55 0.84 107 62 3.01 90 46 0.03 92.5 37 0.61 82 26 1.88 69.5 19 0.52 11.   (*) (*) (*) (*) (*) (*) (*) (*) (*) (*)	Maska	11	98	3.08	20	_		75		3.80	26	2	7	3		22	_ :€	_	
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	ils	101	56.5	1.78	106	10	2,	3		Ξ.	88	22	88	22	2	283	9:5	٠.	

Monthly maximum and minimum temperatures (in degrees Fahrenheit), and the precipitation, at third order stations of the Signal Service, United States
Army, for the year 1885—Continued.

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	·uo	oltaliqinen T	In.	5555 <b>25</b> 5
<b>December.</b>	Temperature.	Minimum.	۰	ಕ್ಷಾಣ್ಣ ಕ್ಷಾಣ್ಣ
Å	Tempe	.momizeM	•	5555 <b>8</b> 5 <b>8</b>
ن ا		Precipitati	Į,	5565362
November.	Temperature.	Minimum.	•	555 <b>245</b> 3
×	Тепр	Maximum.	۰	≘≘ <b>ಾ</b> ≘್ಷ
	•00	Preodpitati	In.	EE
October.	Temperature.	Minimam	•	55 <b>5</b> 4°5+
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	• <b>a</b> c	Precipitati	In.	55 <mark>46548</mark>
September.	Temperature.	.anmini <b>M</b>	۰	ಲಲ್ಹ _ನ ಲಿಲ∞
ž	Temp	.momizaM	•	38333333
	·ac	Precipitati	In.	55.00.00 \$2.00.00 \$1.00.00
August.	Temperature.	.anomiaiM	•	20ggg20g
	Тепр	.mumizaM	•	8239333
	*120	Precipitati	In.	ಕಕ್ಷಕಕ್ಷಕ
July.	Temperature.	.anainiM	•	9998439
	Ten	.mnmizaM	۰	63 <b>66</b> 666
	Stations of the third order		Taking two observations daily at 3 and	p. w. vote merchan time Arke, Alaska Arke, Alaska Hoochnoloo, Alaska Koani, Alaska Koskokvim, Alaska Fyramid Harbor, Alaska Tcha-tow-klin, Alaska

2 Record incomplete.

No record.

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APPENDIX 47.

Mean maximum and mean minimum temperatures (in degrees Fahrenheit), and the number Service, United States Army,

	J	mua	ry.	Fe	brua	7.	1	larcl	1.		Apri	1.		May	•
	Te	mp.		Tel	mp.		Te	mp.		Te	шp.		Te	mp.	
Stations of the third order.	Mean max.	Mean min.	Precipitation.	Mean max.	Mean min.	Precipitation.	Mean max.	Mean min.	Precipitation.	Mean max.	Mean min.	Precipitation.	Mean max.	Mean min.	Precipitation.
Taking one observation daily at anneat:			Dyn	a	0	Dys			Dys	0	0	Dys	۰		Dye
Ashland Oreg	51.4	30. 4	14	55, 5	36, 9	17	70. 1	34.8	1	70, 8	37.9	10	75. 8	43. 8	
Ashland, Oreg	45. 5	35. 6	21	50.8	41.6	23	57. 0	43. 6	10	57. 3	44.0	7		48. 0	
Bowie, Fort, Ariz	55.0	28. 5	3	65.0	36. 5	3	67. 3	43.5	7	73,0	48.0	lΛ	82 5	55 4	1 1
Cape Henlopen, Del.2			l				l						(3)	(3)	(7)
Cape Henlopen, Del.2 Cour d'Alene, Fort, Idaho	30. 4	15. 0	12	39.8	25. 4	16	56. 7	29. 6	4	63.0	33, 4	1 0	.68. 3	40. 5	11
Klamath Fort Oreg	137. 2	119. 9	1 17	40.7		16	59. 6	28. 0	2	61.7	28.0	(3)	66, 5	85. 1	
Lakeview. Oreg	39. 4	22.8	lii	3)	(3)	(3)	60.0	32. 6	1	61.4	34.9	1 8	64. 6	38. 5	
Lakeview, Oreg Lava, N. Mex	57.7	19. 0	2	61.6	22, 5	`4	71. 1	35. 0	10		46.7		83. 1	41.8	, !
Linkville, Oreg Little Egg Harbor, N. J	42.4	25. 0	8		28, 6			33. 2	3	69. 5	35, 9	7		42.0	
Little Egg Harbor, N. J	39. 5	24. 0	12		19, 3	8	38, 0	23. 7	10	55. 2	39, 2	9	61.0	49. 2	
Maricopa, Ariz McDowell, Fort, Ariz Mission, Alaska	64. 5	33. 8	6	72.8	36, 1	2	79. 1	47.8			62, 0		96. 4	14. 2	
McDowell, Fort, Ariz	65. 9	29. 3	l o	71.3	32. 8	2	80.4	45. 4	1	85, 3	48. F			56.8	
Mission, Alaska	16.4	1.1	9	2.4	-20.6	5	28, 1	9. 2	13	42.1	25, 9	12	58. 4	36. 6	' 1
Narragansett Pier, R. I	38.7	20. 7	14	31.2	13, 7	12	38, 3	19. 5	13	55. 3	35.7	9	60.8	44.0	
Neah Bay, Wash	44. 5	34. 9	20	19, 7	39, 9	1 25	54. 9	41.8	10		39, 0			46. 1	
Ocean City, Md	46. G	31. 1	7	37.0	21, 7	9	41.8	27. 6	10		40.8	8	65. 2	51. 2	
Omilak, Alaska	(4)	-2.5	3	(4)	-26.3	4	(4)	0. 1	4	(4)	14.6	6	(4)	(4)	(*)
Phœnix, Ariz	69. 2	31. 2	0	79.6	29, 9	2	81.1	0. 1 37. 8	3		40.5		96. 9	41. 0	
Point Judith, R. I.	38. 0	22. 1	14	31.0	15.1	9	36. E	20. 9	7	50. 3	36, 0	6		45. 1	1
Pysht, Wash Reno, Fort, Ind. T	41. 5	32. 1	16	49, 6	38. 2	25	55, 0	39. 0	10	55, 6	36. 7	7	64.5	44. U	13
Reno, Fort, Ind. T	34. 9	17.7	4	46.5		2	60. 3	38. 1	7	71, 2	46. 9 (3)	6	75. 2	52. 9	
San Carlos Agency, Ariz	55. 9	21.0	1 1		30.2	3	72. 8	44.4	6	77.4	(3)	1	90. 2	(7)	1 .
Spokane, Fort, Wash	25. 2	5. 1	5	(4)	(4)	(4)	65. 7	26. 4			29.7			38. 0	
Supply, Fort, Ind. T	. [34. 8	13. 2	4	46. 2	18, 4	3		33. 4	6	67. 0	46. 3	10	74. 2	52. 3	1
Supply, Fort, Ind. T Ugashik, Alaska	37. 5	22.3	10	20.5	13. 6	10		25. 8			26. 1			32. 3	
Verde, Fort, Ariz	. 152. 0	.26.0	0	63.0	30, 0	5	70. 1	38. 3	7	76. 5	47.0	3	85. 5	52. 5	( )
Wash Woods, N.C	.  52, 3	33.4	13		27. 9	*	47. 7	32. 3	11	64. 2	47. 6	12		55.3	
Wickenburg, Ariz	.  63, 0	28. 7	1 0		32.4			43. 6			45. 0			51. 1	
Willcox, Ariz	61.8	23. 9	3		30, 0			38, 2			39. 2			45. 5	
Yates, Fort, Dak	. [14. 8	0, 2	4	16. 6	- 8, 8	10	45.	16.0	- 8	(³)	(3)	(3)	(4)	(4)	(*)
I'wo observations daily, 3 and 11		1	i .	- 11		1	l	1		1	1	l	i		l
p. m., 75th meridian time:		١	١.			_	l			ļ., .	l	1	i	١	Ì
Anvik, Alaska	4.8	3. 6	8		-23. 4		22. 4	5. 6			24.4	15	53. 3	34.5	
Anvik, Alaska	37. 8	30. 5	27	35.7	28.8			29. 0		41.0	30.3	1 .27	(2)	(2)	(4)
1100chnohoo, Alaska	33.7	22. 5	7	37.4	25. 8	3	(2)	(4)	(4)	L (?)	(4)	(*)	(2)	(2)	(2)
Lenat, Alaska	I (*)	5.3	3	(*)	5. 8 -12. 7	6	(?)	17.4	14	[(2)	29. 2	(')	(4)	(4)	(1)
Kenai, Alaska Koskokvim, Alaska Pyramid Harbor, Alaska Tcha-tow-klin, Alaska	(4)	(3)	( <u>*)</u>	(*)	-12.7	11	l.(°),	24. 5 (4)	9	J_(°)	29. 2 25. 8 (4)	17	(4)	(3)	(9)
Fyramid Harbor, Alaska	27.0	(4)	1 11		(4)	. 12	41.0	(')	l II	50. C	J.(°).	1 8	62, 0		1
TCDS-tow-kill, Alaska	-8. 4	25. 2	1 6	0.5	16.7	8	28.	-i.o	_{[ 8}	33. I	23.4	l a	(3)	(3)	(1)

Observations discontinued October 31, 1885.

² Observations commonced May 17, 1885.

# APPENDIX 47.

of days on which .01 inch or more of precipitation fell at third order stations of the Signal for each month of the year 1885.

	fane.			July.		A	ugus	t.	Sep	tem1	oer.	0	ctobe	er.	No	veml	er.	De	cemb	er.	Annual
Ter	np.		Ter	np.		Ten	op.		Ter	np.		Te	mp.		Ter	mp.		Te	mp.		10.
Mean max.	Mean min.	Precipitation.	Mean max.	Mean min.	Precipitation.	Mean max.	Mean min.	Precipitation.	Mean max.	Mean min.	Precipitation.	Mean max.	Mean min.	Precipitation.	Menn max.	Mean min.	Precipitation.	Mean max.	Mean min.	Precipitation.	No. of days .
o 15.13 63.389.977.467.389.977.467.39 67.374.776.00.774.7754.77 600.7754.77600.7754.7769.384.77554.7769.384.7759.384.7759.384.7759.384.7759.384.7759.384.7759.384.7759.384.7759.384.7759.384.7769.384.7769.384.7769.384.7769.384.7769.384.7769.384.7769.384.7769.384.7769.384.7769.384.7769.384.7769.384.7769.384.7769.384.7769.384.7769.384.7769.384.7769.384.7769.384.7769.384.7769.384.7769.384.7769.384.7769.384.7769.384.7769.384.7769.384.7769.384.7769.384.7769.384.7769.384.7769.384.7769.384.7769.384.7769.384.7769.384.7769.384.7769.384.7769.384.7769.384.7769.384.7769.384.7769.384.7769.384.7769.384.7769.384.7769.384.7769.384.7769.384.7769.384.7769.384.7769.384.7769.384.7769.384.7769.384.7769.384.7769.384.7769.384.7769.384.7769.384.7769.384.7769.384.7769.384.7769.384.7769.384.7769.384.7769.384.7769.384.7769.384.7769.384.7769.384.7769.384.7769.384.7769.384.7769.384.7769.384.7769.384.7769.384.7769.384.7769.384.7769.384.7769.384.7769.384.7769.384.7769.384.7769.384.7769.384.7769.384.7769.384.7769.384.7769.384.7769.384.7769.384.7769.384.7769.384.7769.384.7769.384.7769.384.7769.384.7769.384.7769.384.7769.384.7769.384.7769.384.7769.384.7769.384.7769.384.7769.384.7769.384.7769.384.7769.384.7769.384.7769.384.7769.384.7769.384.7769.384.7769.384.7769.384.7769.384.7769.384.7769.384.7769.384.7769.384.7769.384.7769.384.7769.384.7769.384.7769.384.7769.384.7769.384.7769.384.7769.384.7769.384.7769.384.7769.384.7769.384.7769.384.7769.384.7769.384.7769.384.7769.384.7769.384.7769.384.7769.384.7769.384.7769.384.7769.384.7769.384.7769.384.7769.384.7769.384.7769.384.7769.384.7769.384.7769.384.7769.384.7769.384.7769.384.7769.384.7769.384.7769.384.7769.384.7769.384.7769.384.7769.384.7769.384.7769.384.7769.384.7769.384.7769.384.7769.384.7769.384.7769.384.7769.384.7769.384.7769.384.7769.384.7769.384.7769.384.7769.384.7769.384.7769.384.7769.384.7769.384.7769.384.7769.384.7769.384.7769.384.7769.384.7769.384.7769.384.7769.384.7769.384.7769.384.7769.384.7760.384.7860.384.7860.384.7860.384.7860.384.7860.7860.7860.7860.7860.7860.7860.7860	61.1 1 59.8 48.8 48.8 56.5 53.5 69.3 36.5 58.6 69.3 36.5 54.8 7 (*) 54.3 56.7 48.1 56.7 69.3 7.0 56.2 69.2 69.2 69.2 69.2 69.2 69.2 69.2 6	(4) (3) (4) (4) (4) (6) (7) (7) (6) (7) (1) 11 12 4 4 4 4 11 11 11 11 18 8 1	69. 6 94. 1 82. 6 80. 5 87. 0 88. 1 81. 5 107. 1 1104. 4 (4) 98. 1 (5) 98. 1 (6) 98. 2 80. 6 61. 8 98. 6 61. 8 98. 6 104. 9 104.	52. 2 56. 6 6 9 6 9 51. 9 42. 2 58. 6 67. 0 3. 2 58. 6 67. 0 67. 0 1 79. 8 6 79. 8 6 79. 8 6 79. 8 6 79. 8 6 79. 8 6 79. 8 6 79. 8 6 79. 8 6 79. 8 6 79. 8 6 79. 8 6 79. 8 6 79. 8 6 79. 8 6 79. 8 6 79. 8 6 79. 8 6 79. 8 6 79. 8 6 79. 8 6 79. 8 6 79. 8 6 79. 8 6 79. 8 6 79. 8 6 79. 8 6 79. 8 6 79. 8 6 79. 8 6 79. 8 6 79. 8 6 79. 8 6 79. 8 6 79. 8 6 79. 8 6 79. 8 6 79. 8 6 79. 8 6 79. 8 6 79. 8 6 79. 8 6 79. 8 6 79. 8 6 79. 8 6 79. 8 6 79. 8 6 79. 8 6 79. 8 6 79. 8 6 79. 8 6 79. 8 6 79. 8 6 79. 8 6 79. 8 6 79. 8 6 79. 8 6 79. 8 6 79. 8 6 79. 8 6 79. 8 6 79. 8 6 79. 8 6 79. 8 6 79. 8 6 79. 8 6 79. 8 6 79. 8 6 79. 8 6 79. 8 6 79. 8 6 79. 8 6 79. 8 6 79. 8 6 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(*) (4) 66. 7 (*) (4) 70. 0	42.5	(4) (4) (4) (4) (5)	(4) (4)	(4) (4) (46, 2 47, 0 (4) (4)		(4)	(4) (4) (46, 6) (45, 9) (49, 1) (4)	(4)	(t)	(4) (4) (4) (4) (4) (4) (4) (4)	(4) (4)	(4)	(4) 36, 4 34, 7 3 26, 2	(4)		(4) (4) (4) 9, 3 47, 2 (4)	13	(4) (4) (4) (4) (4) (2) (3)	(°) (°) (°) 4. 5 12. 6		

⁸ Record incomplete.

⁴ No record.

#### APPENDIX 48.

Mean relative humidity at stations of the Signal Service, United States Army, for each month and the year.

[Computed from the commencement of observations to December, 1805, inclusive. Observations prior to August 25, 1872, were taken at 7.25 a.m., 4.25, and 11.25 p.m., Weshington time; from August 25, 1872, to November 1, 1879, at 7.25 a.m., 4.25, and 11 p.m., Washington time; from November 1, 1879, to December 31, 1804, at 7 a.m., 2, and 11 p.m., Washington time; and from January 1 to December 31, 1805, at 7 a.m., 3, and 11 p.m., 75th meridian time.]

Districts and stations.	January.	February.	March.	April.	May.	June.	July.	Angust.	September.	October.	November.	December.	Appual.
	P.a.	P.a.	P. a	P.a.	 Р. a.	<u> </u>	P.a.	P. et.	P.a.	P.a.	P. et.	P.a.	P.a.
Now England.	۱ ــ	76	i 75	_	74	76	79	_	-	- 1		_	_
Portland, Mc	77	70	13	72	6	64	71	79 73	74	77	75 72	74	70
Mount Washington, N. H	85	84	-	87	84	83	87	86	85	88	87	84	~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~
Boston, Mass	72	70	70	66	65	08	70	73	73	70	71	73	70
Block Island, R. I	76	78	75	76	83	83	83	83	82	79	78	79	79
New Haven, Conn	74	74	70	65	67	20	72	75	75	73	72	74	72
New London, Conn	74	72	72	<b>68</b>	70	74	76	78	77	75	72	73	73
Albany, N. Y	75	74	71	63	62	66	67	88	72	72	74	76	70
New York City	74	73	68	65	66	. 👸	71	72	72	70	70	73	79
Philadelphia, Pa	74	70	67	64	65	68	48	72	71	70	80	73	- 30
Atlantic City, N. J	80	78	78	77	80	82	82	82	81	79	78		-
Bernegat City, N. J.	81	79	76	75	77	79	80	80	80	79	78		79
Cape May, N. J	7H	77	76	75	77	73	74	81 75	77	75 73	73	76 75	77
Baltimore, Md	70	67	65	60	61	64	64	6	70	<b>3</b>	*	=	86
Washington City	74	80	1 66	62	64	67	67	72	73	72	n	73	=
Cape Henry, Va	1 77	74	73	71	73	74	75	78	76	73	71	73	74
Chincoteague, Va		80	76	1 77	82		82	83	81	) <b>20</b>	78	79	-
Lynchburg, Va		65	57	58	61	67	66	71	70		65	67	<b>6</b>
Norfolk, Va	75	71	67	68		70	71	76	76	75	73	72	72
South Atlantic States: Charlotte, N. C	72	67	63	62	62	64	65	69	70	70	68	70	67
Hatteras, N. C	85	81	78	80	82	83	81	82	81	81	79	81	81
Kitty Hawk, N. C	80	76	76	76	79	79	79	81	80	78	76	77	79
Kitty Hawk, N. C Macon, Fort, N. C	83	81	77	81	81	84	83	84	84	83	81	81	82
Smithville, N. C	. 81	77	76	78	77	77	78	80	80	79	72	78	78
Wilmington, N. C		69	68	68	71	74	75	79	77	75	72	72	73
Charleston, S. C		72 68	70 65	71 65	72 65	74	75	77	77	77	74 72	74 78	74 70
Augusta, Ga Savannah, Ga		60	68	66	69	72	72	76	78	76	72	71	72
Jacksonville, Fla	75	71	67	68	8	72	72	75	78	75	75	74	73
Florida Peninsula :	1	'-	••	~	-	'-	1	1	'-			1.5	
Cedar Keys, Fla	81	76	73	74	71	75	74	76	77	77	79	82	76
Key West, Fla	. 80	77	71	70	71	71	70	72	76	76	78	79	74
Beniord, Fla	78	74	72	71	73	81	77	80	83	80	81	76	77
Eastern Gulf States : Atlanta, Gs	72	64	60	61	63	67	67	73	71	71	66		67
Pensacola, Fla.		76	74	77	74	77	78	79	78	75	74	n	76
Mobile, Ala	78	74	73	73	71	74	76	78	75	75	76	78	75
Montgomery, Ala	74	67	65	65	65	69	70	72	70	69	71	73	89
Vicksburg, Miss	71	66	64	66	68	70	72	72	72	72	70	70	79
New Orleans, La	72	69	70	70	70	72	73	74	73	71	72	73	72
Western Gulf States: Shreveport, La	74	70	66	67	70	70	72	70	71	73	72	72	n
Fort Smith, Ark		72	64	68	72	76	76	74	72	76	68	1 71	7.
Little Rock, Ark		73	66	68	75	76	75	76	77	77	73	72	74
Galveston, Tex	79	78	79	76	74	73	73	73	74	74	77	80	76
Indianola, Tex	H2	78	80	77	78	76	76	76	78	76	78	81	78
Palestine, Tex	60	68	65	72	76	77 60	74	72	72	74 60	68	70	71 68
San Antonio, Tex	72	68	67	75	70	00	04	01	1 "	w	90	′"	
Brownsville, Tex	79	79	80	76	77	74	73	75	78	78	78	80	78
Bio Grande City, Tex	72	66	71	67	60	67	60	67	69	72		Œ	
¹ Station closed Decer		11. 188	25			28to	tion .	closed	Octo	hor 3	l. 1885		

¹Station closed December 31, 1885.

²Station closed October 31, 1885.

Mean relative humidity at stations of the Signal Service, &c.—Continued.

Districts and stations.	January.	February.	March.	April.	May.	June.	July.	Angust	September.	October.	November.	December.	Annual.
	P. ct.	P. et.	P. ot.	P. ct.	P. ct.	P. ot.	P. ct.	P. ct.	 P. ct.	P. et.	P. ct.	P. ct.	P. ct.
hio Valley and Tennessee:		i	İ	i	i	i		1	İ	1			١.,
Chattanooga, Tenn Knoxville, Tenn	75	68	64	64	68 65	72	73	77 74	77	76 72	71 72	72	71 70
Memphis, Tenn	73	68	62	62	65	70	70	70	71	71	68	71	68
	73	70	64	63	63	68	69	69	70	69	70	72	68
Greencestle Ind	72 81	68 81	63	59 71	62 69	67 75	67 76	67 77	60 76	68 76	68 77	71 81	67 76
Nachville, Tenn Louisville, Ky Greencaptle, Ind Indianapolis, Ind Cincinnati Obio	74	71	67	60	61	68	68	68	68	68	71	74	68
		70	66	60	60	65	64	66	67	67	60	72	66
Columbus, Ohio	74	72 73	67	64	64 63	66 66	64 68	67 70	69 71	71 71	71 71	75 76	68
ower Lakes :	۳ ا	<b>,</b> "	•	03	03	· •	•				•	10	l '`
Buffalo, N. Y	80	78	75	71	68	71	72	71	72	73	76	70	74
Oswego, N. Y Rochester, N. Y	74 80	74	73 76	68 67	67 64	70 67	71 68	71 68	71 70	71 72	71 76	76 80	78 7:
Brie, Pa	79	78	76	70	66	70	70	70	72	72	75	79	7
Cleveland, Ohio	78	75	75	67	65	69	70	70	70	70	74	78	7:
Sanduaky, Ohio	76 75	74 74	74	68 64	66 63	<b>69</b>	69	69 71	71 72	72 71	78 72	76 75	7
Detroit, Mich	177	75	73	64	63	69	70	71	72	71	74	78	ıγ̈́
pper Lakes :	1	Ì	1	ĺ	i				1	1 1	l i	i i	i
Alpena, Mich	77	74	76	70	70 <b>69</b>	73	73	76	77	78	82 78	80	7:
Grand Haven, Mich	75 78	72 76	71 76	69	67	72 72	72 73	76 75	77 75	76 74	76	78 79	7.
Mackinaw City, Mich	75	74	72	7i	72	74	75	77	77	74	78	79	7:
Marquette, Mich Port Huron, Mich	78	72	72	66	64	68	68	70	70	70	74	76	7
Chicago, Ill	80   75	79 73	78 72	72 67	<b>69</b>	73 71	74 71	73 71	74 69	75 70	80 72	82 75	70
Milwaukee, Wis	79	78	76	71	69	73	74	75	74	73	76	79	7
Doloth Minn	75	72	69	67	68	72	68	73	73	70	76	76	7:
pper Mississippi Valley : Saint Paul, Minn La Crosse, Wis	74	70	60	62	62	70	71	72	71	70	73	75	70
La Crossa, Wis.	72	71	69	62	59	68	70	69	72	68	73	74	l é
Davenport, Lows	73	72	69	63	64	70	69	68	69	67	70	74	a
Des Moines Tows	70	69	68	64	66	73	72	70	70	71	70	73	70
Dubuque, Iowa	75	68 73	67	61 65	61 65	69 71	67	<b>69</b>	70 <b>68</b>	69 69	71 71	71 75	7
Dubuque, Iowa Keokuk, Iowa Cairo, Ill	74	70	64	62	67	73	72	72	73	71	69	72	7
Springfield, Ill	72	89	64	63	65	71	65	65	66	69	67	71	6
Saint Louis, Mo	72	70	66	61	65	69	69	67	66	66	68	72	6
Leavenworth, Kans	73	70	65	62	65	67	68	65	64	64	65	71	6
Omaha Nehr	73	72	68	61	65	69	71	70	70	66	70	73	
Bennett, Fort, Dak. Huron, Dak.	73 65	73 68	72 70	67	67 71	70 75	68   77	65 76	63 72	65 70	72 70	74	6 7
Yankton, Dak	68	60	68	66	66	71	72	71	68	65	68	67	ĺé
xtreme Northwest:	1	''			l.					1			i
Moorhead, Minn	81 91	79 84	78 84	74 78	68 71	72 76	74 80	73 81	72 78	75 79	81 83	84 86	8
Saint Vincent, Minn Bismarck, Dak	78	78	75	68	64	67	64	63	63	65	74	75	1 2
Buford, Fort, Dak	75	74	76	69	63	69	67	63	62	67	77	77	1 7
Totten, Fort, Dak	72	75	83	77	68	76	77	74	69	70	84	78	7
orthorn Slope : Assinaboine, Fort, Mont	66	68	68	60	55	56	54	53	57	61	64	62	١٠
Benton, Fort, Mont	70	72	64	62	63	61	51	50	57	62	62	63	
Benton, Fort, Mont Custer, Fort, Mont	74	78	68	61	62	65	52	47	54	58	65	69	9
Helena, Mont	1 62	70	46	61 53	56 54	59 51	52 53	49 51	57 57	62 59	63 54	64 51	1
Poplar River, Mont. Shaw, Fort, Mont. Deadwood, Dak. Cheyenne, Wyo. North Platte, Nebr.	91	92	92	82	69	73	75	73	69	72	77	86	į
Shaw, Fort Mont	73	70	63	58	56	59	55	54	58	62	62	63	9
Chevenne Wyo	68 55	57	57	50	68 59	67 50	50	61 50	60 45	63 48	66 52	68 57	6
North Platte, Nebr	70	68	64	60	65	64	66	65	62	63	65	70	6
naaie erobe :	1	l	١		١	١		١			۱ ۔۔	١	
Denver, Colo Pike's Peak, Colo	68	54   70	49 73	50   77	50 73	66	47 66	48 68	68	70	50 68	56 71	1 3
West Las Animas, Colo		66	51	40	58	57	53	58	52	59	61	69	1 8
Dodge City, Kans	. 69	67	60	55	65	63	61	65	60	63	62	67	1 (
Elliott, Fort, Tex	. 62	56	49	49	50	56	55	56	56	63	54	55	4
outhern Slope: Sill. Fort. Ind. Ter	68	66	60	57	67	67	64	62	65	66	G6	70	١.
Sill, Fort, Ind. Ter Concho, Fort, Tex.*	68	64	60	58	63	60	58	63	66	69	66	65	(
Davis, Fort, Tex	.   57	49	48	40	47	48	55	58	60	55	54	54	
Stockton, Fort, Tex outhern Plateau:	. 57	53	52	48	50	57	54	55	63	G1	59	59	1

¹ Station closed November 30, 1885.

² Station closed September 15, 1885.

#### Mean relative humidity at stations of the Signal Service, &c.—Continued.

Districts and stations.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Appual.
	Pet	P. et.	P. et	Pet	Pet	Pel	P. ct.	Pet	1. 4	Pet	P et	Pa	P. et
Southern Plateau—Continued:										12.00			
El Paso, Tex	52	48	40	33	34	36	46	52	54	55	55	55	48
Apache, Fort, Ariz	63	61	58	46	40	37	65	61	52	51	56	61	54
Grant, Fort, Aris	50	48	42	31.	25	26	45	54	41	28	43	49	41
Prescott, Ariz	67	56	51	45	34	30	46	53	44	44	51	50	49
Thomas, Fort, Ariz	65	61	56	41	36	34	45	54	48	48	57	66	Si
Yuma, Ariz	46	45	44	42	27	38	42	46	44	1 44	45	50	44
Middle Platean:		••	٠.	٠-	٠.	~		1 "				••	
Winnemucca, Nev	63	62	50	51	41	25	23	22	29	44	50	64	46
Salt Lake City, Utah	59	58	50	48	42	25	32	33	34	44	53	61	46
Northern Plateau :	"		"	"				_	"	***	-		,
Boisé City, Idaho	77	75	65	GO	56	51	42	42	50	62	70	77	60
Lewiston, Idaho'	70	69	63	63	60	6i	45	44	54	668	75	77	62
Dayton, Wash.2	81	76	68	61	62	60	52	50	58	68	80	82	67
Spokane Falls, Wash	8i	80	75	67	60	61	54	54	65	76	81	ão	70
North Pacific Coast:	٠.	~		٠.	-	٠.	٠.	٠,			٠.	۳ ا	
Canby, Fort, Wash	85	85	84	85	81	87	83	86	88	88	91	90	87
Olympia, Wash	85	84	82	78	72	70	68	73	80	84	86	86	79
Tatoosh Island, Wash	85	81	84	83	86	87	89	92	90	88	89	82	RE
Portland, Oreg	79	79	75	70	65	65	64	67	70	78	79	80	72
Roseburg, Oreg	83	80	75	72	67	65	62	62	66	78	85	86	73
Middle Pacific Coast:	۳,	55		٠- ا	٠, ا	۳ ا	ا ت				۰		!
Cape Mendocino, Cal	80	80	83	84	85	85	87	88	80	82	81	82	83
Red Bluff, Cai	73	70	62	64	51	40	84	34	41	51	66	75	55
Sacramento, Cal	79	75	70	70	63	59	55	55	55	62	71	80	67
San Francisco, Cal	74	74	73	73	73	75	79	80	78	74	73	76	75
South Pacific Coast:	• • • • • • • • • • • • • • • • • • • •												i
Los Angeles, Cal	63	67	72	71	71	70	70	69	70	66	62	64	64
San Diego, Cal	71	7.1	75	73	74	74	76	77	77	73	GH	68	71
Alaska stations:	٠- ا					•••			•••		۳.	. ~	
Saint Michael's, Fort	96	96	96	91	91	84	83	86	86	89	91	93	91
Sitka	77	76	74	70	75	77	80	80	81	76	77	77	76
Unalashka	86	84	82	80	77	79	79	82	62	84	79	81	1 20
Behring's Island, Behring Ses	87	80	88	90	89	88	92	92	87	85	89	87	20

¹ Station closed December 31, 1885.

Station closed November 30, 1885.

### APPENDIX 49.

Date of the first frost at stations of the Signal Service, United States Army, east of the looky Mountains, for the winter of 1835-'86.

			1	Date
ew England:			Lower Lakes—Continued :	
Eastport, Me	Oct.	8	Oswego, N. Y	0-4
Portland, Me		7	Rochester, N. Y	Oct.
Portland, Me	(*)	. 1	Erie, Pa	Oct.
Boston, Mass	Sept	. 24	Cleveland, Ohio.	Oct.
Block Island, R. I.			Sandusky, Ohio	Oct
New Haven, Conn			Toledo, Ohio	Oct.
New London, Conn	Oct.	23	Detroit, Mich.	Sept
iddle Atlantic States:		-	Upper Lakes:	Sept.
	Oct.	7	Albana Mak	
Albany, N. Y.	Oct	7	Alpena, Mich	Sept.
New York City			Escanaba, Mich.	Aug.
Philadelphia, Pa	Oct		II trand Haven Mich	Sept.
Atlantic City, N.J	Oct		I Mackinsw City, Mich	Sept.
Rarnegat City, N. J.2	Nov.		II ALLIUUUULU MICH.	Sept.
Barnegat City, N. J. ²	Nov.		Port Huron, Mich	Sept.
Baltimore, Md	Oct.		Chicago, Ill	Sept.
Washington City	Oct	22	Milwankee Wia	
Cape Henry, Va	Dec.	3	Doloth, Minn	Oct.
('hincotoggue Va	Oct	12	Upper Mississippi Valley:	Sept.
Lynchburg, Va	Out.	5	Saint Paul Minn	
Norfolk, Va.	Uct.	22	Saint Paul, Minn La Crosse, Wis	Sept.
A tlamtia Statan .	1		Davarrant Jame	Aug.
Charlotta N C	Oct.	5	Davenport, Iowa	Oct.
Charlotte, N. C. Hatterse, N. C. Kitty Hawk, N. C. Macon, Fort, N. C. Smithville, N. C. Wilmington, N. C.	Dec.		Des Moines, Iowa.	Oct.
Vissa Unamb W C	Dec.		Dubuque, Iowa	Aug.
Kitty Hawk, N. C	Dec.		Keokuk, Iowa	Oct.
Macon, Fort, N. C	Nov.	. 4	Cairo, Ill	Oct.
Smithville, N. C	Oct. Oct. Oct. Oct.	22	Springheld, Ill	Oct.
Wilmington, N. C	Oct.	22	Saint Louis, Mo	Oct.
Charleson, S. C	Oct.	23	Missouri Valley:	OU.
Augusta, Ga	Oct.	23	Lamar, Mo	Oct.
Savannah, Ga	I Nov.	15	Leavenworth, Kans	
Jacksonville, Fla	Nov.	16	Omaha, Nebr	Oct.
lorida Peninsula:	1	- 1	Valentine, Nebr	Oct.
Cedar Keva Fla	Dec.	6	Bennett, Fort, Dak	Sept.
Cedar Keys, Fla	(4)		Huran Dak	Sept.
Sanford, Fla	Nov.	25	Huron, Dak Sully, Fort, Dak	Sept.
estern Gulf States:			Yankton, Dak	Sept.
Atlanta, Ga	Cock	5	Extreme Northwest:	Sept.
Pensacola, Fla	Oct.		Moort and Minn	
Mobile, Ala	Oct.		Moorhead, Minn Saint Vincent, Minn	Aug.
Montgomery, Ala	Úct.		Rismonele Dele	Aug.
Vicksburg, Miss	Oct.	15	Bismarck, Dak	Sept.
New Orleans, La	Dec.		Buford, Fort, Dak	Sept.
estern Gulf States:	Dec.	3	Totten, Fort, Dak	Aug.
	Oct.	ا مه	Northern Slope:	_
Shreveport, La			Assinabolne, Fort, Mont	Oct.
Fort Smith, Ark	Oct	.4	Denion, Fort, Mont	Sept.
Little Rock, Ark	Oct.		Urter, Fort, Mont	Oct.
Galvesion, Tex	Jan.	7	II LICIOUS, MONE	Oct.
Galveston, Tex Indianola, Tex Palestine, Tex	Dec.		II ALBEIDDIR FORK MONT	Sept.
Palestine, Tex	Oct.		PODIAT RIVAT Mont	Sept.
San Antonio, Tex	Nov.	14	Shaw, Fort, Mont.	Sept
lo Grande Valley:	1		Shaw, Fort, Mont.  Deadwood, Dak Cheyenne, Wyo.	Sept.
Brownsville, Tex	Dec.	15	Chevenne, Wvo	
Brownsville, Tex Rio Grande City, Tex	Nov.		North Platte, Nebr	Oct.
hio Valley and Tennessee:		-	Middle Slope:	Oct.
Chattanooga, Tenn	Oct.	5		٠.
Knoxville, Tonn	Oct.	7	Pike's Peak Cole	Oct.
Chattanooga, Tenn Knoxville, Tenn Memphis, Tenn Nashville, Tenn	Oct.	À :	Pike's Peak, Colo	~ (3)
Nashvilla Tunn	Sept	94	West Las Animas, Colo	Sept.
Taniarilla Ku	Sone	- 57	Concordia, Kans	Oct.
Louisville, Ky	Sept	- 47	Douge City, Kana.	Oct.
Greencastle, Ind	. Sept	. 24	Finite For Tex	Oct.
Indianapolis, Ind			SOULDATH SIONA •	
Cincinnati, Ohio	Sept		Sill, Fort, Ind. T	Oct.
Columbus, Ohio	Oct	8 ;	Sill, Fort, Ind. T. Abilene, Tex	Oct.
Pittaburg, Pa	Oct.	7		Oct.
ower Lakes:	1		Stockton, Fort, Tex	(4)
Buffalo, N. Y	Sept		Stanton, Fort, N. Mex	

Station closed November 30, 1885.
 Station closed December 31, 1885.
 Frost each month.

⁴ No frost observed. ⁵ No reliable records.

# APPENDIX 50.

Date of the last frosts at stations of the Signal Service, United States Army, east of the Rocky Mountains, for the winter of 1885-'86.

Date	×8.	Districts and stations.	Date	4.
		Lower Lakes—Continued:		
Apr.		Oswego, N. Y	May	
Apr.	12	Rochester, N. Y	May	17
(1)		Erie, Pa	May	17
May	1	Cleveland, Ohio	Apr.	
Apr.	5	Sanduaky, Ohio	Apr.	. 1
June		Toledo, Öhio	Apr.	. 1
Apr.	9	Detroit, Mich	May	17
-		Upper Lakes:		
May		Alpena, Mich	June	
Apr.		Escanaba, Mich		
Apr.		Grand Haven, Mich		
Apr.		Mackinaw City, Mich	June	
Apr.		Marquette, Mich	May	
	17	Port Huron, Mich	Juno	1
Mar.		Chicago, Ill	May	2
Mar.		Milwaukee, Wis	June	•
Mar.	18	Duluth, Minn	June	•
Anr	10	Upper Mississippi Valley:		
Apr.	9	Saint Paul, Minn	May	1
1		La Crosse, Wis	May	. 1
Mar.	14	Davenport, Iowa	Apr.	
Feb.	8	Des Moines, Iowa	May	
Mar.	11	Dubuque, Iowa	(A)	
Mar.	11	Keokuk, Iowa	May	1
	24	II Cairo III	Apr.	
Mar.	24	Springfield, Ill	May	. 1
Mar.		Saint Louis, Mo		
Apr.	9		•	
Apr.			Apr.	
Mar.		Leavenworth, Kans		
		Omaha Nebr		
Feb.	6	Valentine, Nebr	May	1
1 (3)		Huron, Dak	May	, -
. Apr.	7	Sully, Fort, Dak	June	ь
		Yankton, Dak	May	1
. Apr.	8	Extreme Northwest:	•	
. Apr.	6	Moorhead, Minn	June	Ð
. Apr.	6	Saint Vincent, Minn	June	0
. Anr.	6	Bismarck, Dak	May	. 1
Ane	6	Buford, Fort, Dak	May	. 1
Mar.		Totten, Fort, Dak	June	
1		Northern Slope:		
. Apr.	7	Assinabolne, Fort, Mont	May	, 1
. Apr.	1	Benton, Fort, Mont	May	, 1
. Anr.	1	Custer, Fort, Mont	Apr.	. 2
. Feb.	5	Helena, Mont	May	7
. Feb.	3	Maginnia, Fort. Mont	May	1
. Apr.	7	PODIAL RIVER MODE.	I MAV	71
. Apr.	5	Shaw, Fort, Mont	May	, 1
		Deadwood, Dak	May	, 1
. Jan.	30	Unevenue, w vo	May	, 1
. Jan.	24	North Platte, Nebr		
1		Middle Slope:	1 -	
. Apr.	8	Denver, Colo	May	, 1
. Apr.		Pike's Peak, Colo		
. Apr.		West Las Animas, Colo	l Adr.	. :
. May	1	Concordia Kana	Ann	: :
. Apr.	9	Dodge City, Kans	Mar	1
. May	17	Elliott, Fort, Tex	Apr.	
. Apr.		Southern Slope:		
Ane	9	Sill, Fort, Ind. T.	P	)
. Mav	17	Abilene, Tex		
. June	4	Davis, Fort, Tex	Ant	
1		Stockton, Fort, Tex.	Mar	
1		Stanton, Fort, N. Mex		•
	Apr. Apr. June Apr. Apr. Apr. Apr. Apr. Apr. Apr. Apr.	Apr. 29 Apr. 12 May 1 Apr. 5 June 1 Apr. 5 Apr. 9 Apr. 9 Apr. 18 Mar. 18 Mar. 18 Apr. 10 Mar. 18 Mar. 11 Mar. 14 Apr. 9 Mar. 11 Mar. 24 Apr. 9 Mar. 11 Feb. 6 Apr. 6 Apr. 6 Apr. 6 Apr. 6 Apr. 6 Apr. 6 Apr. 6 Apr. 6 Apr. 7 Apr. 1 Feb. 5 Feb. 3 Apr. 1 Apr. 1 Apr. 1 Apr. 1 Apr. 5 Feb. 5 Feb. 3 Apr. 6 Apr. 6 Apr. 6 Apr. 6 Apr. 6 Apr. 6 Apr. 6 Apr. 6 Apr. 6 Apr. 7 Apr. 1 Apr. 1 Apr. 1 Apr. 1 Apr. 1 Apr. 2 Apr. 1 Apr. 2 Apr. 8 Apr. 9 Apr. 8 Apr. 9 Apr. 8 Apr. 9 Apr. 8 Apr. 9 Apr. 8 Apr. 9 May 17	Apr. 29 Apr. 12 (1) May 1 Apr. 5 June 1 Apr. 5 June 1 Apr. 9 Apr. 9 Apr. 4 May 26 Apr. 4 May 17 Apr. 4 May 17 Mar. 18 Mar. 8 Mar. 18 Apr. 10 Apr. 9 Apr. 10 Apr. 9 Apr. 10 Apr. 9 Apr. 10 Apr. 9 Apr. 10 Apr. 9 Apr. 4 Mar. 18 Apr. 10 Apr. 9 Apr. 10 Apr. 9 Mar. 11 Mar. 12 Mar. 12 Mar. 14 Apr. 10 Apr. 9 Mar. 11 Mar. 14 Apr. 10 Apr. 9 Mar. 11 Mar. 14 Apr. 10 Apr. 9 Mar. 11 Mar. 14 Apr. 10 Apr. 9 Mar. 11 Mar. 24 Mar. 12 Mar. 24 Mar. 24 Mar. 24 Mar. 24 Mar. 24 Apr. 9 Mar. 11 Mar. 24 Apr. 9 Mar. 11 Mar. 24 Apr. 9 Mar. 11 Apr. 1 Feb. 6 Apr. 6 Apr. 6 Apr. 6 Apr. 6 Apr. 6 Apr. 6 Apr. 6 Apr. 6 Apr. 6 Apr. 6 Apr. 6 Apr. 6 Apr. 7 Apr. 1 Apr. 1 Apr. 1 Apr. 1 Apr. 1 Apr. 1 Apr. 1 Apr. 1 Apr. 1 Apr. 1 Apr. 2 Apr. 2 Apr. 2 Apr. 3 Apr. 7 Apr. 1 Apr. 1 Apr. 1 Apr. 1 Apr. 1 Apr. 1 Apr. 1 Apr. 1 Apr. 1 Apr. 1 Apr. 1 Apr. 1 Apr. 1 Apr. 1 Apr. 1 Apr. 1 Apr. 1 Apr. 1 Apr. 2 Apr. 2 Apr. 3 Apr. 7 Apr. 1 Apr. 1 Apr. 1 Apr. 1 Apr. 1 Apr. 1 Apr. 1 Apr. 1 Apr. 2 Apr. 2 Apr. 3 Apr. 7 Apr. 1 Apr. 1 Apr. 1 Apr. 1 Apr. 1 Apr. 1 Apr. 1 Apr. 2 Apr. 2 Apr. 3 Apr. 7 Apr. 1 Apr. 2 Apr. 8 Apr. 7 Apr. 1 Apr. 1 Apr. 1 Apr. 2 Apr. 8 Apr. 9 Apr. 9 Apr. 9 Apr. 9 Apr. 8 Apr. 7 Apr. 1 Apr. 1 Apr. 1 Apr. 1 Apr. 1 Apr. 2 Apr. 8 Apr. 7 Apr. 8 Apr. 9 Apr. 9 Apr. 9 Apr. 9 Apr. 9 Apr. 9 Apr. 9 Apr. 9 Apr. 9 Apr. 1 Apr. 1 Apr. 1 Apr. 1 Apr. 2 Apr. 8 Apr. 7 Apr. 8 Apr. 9 Apr. 9 Apr. 8 Apr. 9 Apr. 9 Apr. 9 Apr. 9 Apr. 9 Apr. 9 Apr. 9 Apr. 9 Apr. 9 Apr. 9 Apr. 9 Apr. 9 Apr. 9 Apr. 9 Apr. 9 Apr. 9 Apr. 9 Apr. 9 Apr. 9 Apr. 9 Apr. 9 Apr. 9 Apr. 9 Apr. 9 Apr. 9 Apr. 9 Apr. 9 Apr. 9 Apr. 9 Apr. 9 Apr. 9 Apr. 9 Apr. 9 Apr. 9 Apr. 9 Apr. 9 Apr. 9 Apr. 9 Apr. 7 Apr. 1 Apr. 1 Apr. 1 Apr. 1 Apr. 1 Apr. 1 Apr. 1 Apr. 1 Apr. 2 Apr. 8 Apr. 7 Apr. 8 Apr. 7 Apr. 8 Apr. 7 Apr. 8 Apr. 9 Apr. 9 Apr. 9 Apr. 9 Apr. 9 Apr. 9 Apr. 9 Apr. 1 Apr. 1 Apr. 1 Apr. 1 Apr. 1 Apr. 1 Apr. 1 Apr. 1 Apr. 1 Apr. 1 Apr. 1 Apr. 1 Apr. 2 Apr. 8 Apr. 7 Apr. 8 Apr. 7 Apr. 8 Apr. 9 Apr. 9 Apr. 9 Apr. 9 Apr. 9 Apr. 9 Apr. 9 Apr. 9 Apr. 7 Apr. 1 Apr. 1 Apr. 1 Apr. 1 Apr. 1 Apr. 1 Apr. 1 Apr. 1 Apr. 1 Apr. 1 Ap	Apr. 29

¹ Frost each month.

² Ne frost reported.

² No reliable record.

APPENDIX 51.

Average movement of the wind at stations of the Signal Service, United States Army, for each month and the year.

[Computed from the commencement of observations at each to December, 1885, inclusive.]

Districts and stations.	January.	Febru-	March.	April.	May.	June.	July.	August.	Septem- ber.	October.	Novem- ber.	Decem- ber.	Annual.
New England: Eastport, Me Portland, Mo. Boston, Mass. Block Island, R. I. New Haven, Conn. New London, Conn.	#1766. 9, 213 5, 589 12, 580 5, 983 6, 819	Miles. 8, 479 5, 682 7, 851 11, 807 5, 673 5, 673	Miles. 9, 389 6, 709 19, 512 6, 883 6, 753	Miles. 7, 218 6, 858 7, 409 10, 149 6, 453 6, 004	###66. 6, 138 6, 138 6, 642 9, 786 5, 470 5, 323	Miles. 4, 871 4, 996 5, 825 9, 068 4, 802 4, 399	Miles. 4, 540 4, 903 5, 564 8, 436 4, 477 4, 253	Miles. 4, 254 4, 886 6, 450 7, 824 4, 358 4, 004	Miles. 5, 330 4, 844 5, 988 9, 718 4, 837 4, 385	Miles. 7, 124 5, 439 6, 765 10, 968 5, 470 5, 230	Miles. 8, 479 5, 970 7, 522 12, 173 5, 918	Miles. 8, 867 5, 943 1, 675 13, 466 6, 014 5, 721	Miles. 83, 961 67, 859 128, 682 128, 082 68, 186
Middle Atlantic States: Albaury, N. Y. New York City Philadephila, Ta. Atlantic City, N. J. Barnegat City, N. J. Cape Mory, N. J. Sandy Hook, N. J.	7,7,868 7,7,868 110,275 111,004	7,7,476 7,7,289 7,7289 11,145 10,145	4 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8	844,44,949,94,94,94,94,94,94,94,94,94,94,	999 977 7 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9	. 8 9 9 7 7 7 8 8 8 8 8 8 8 8 8 8 8 8 8 8	8 4 4 4 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6	සඳපැළඹුදුණු 443 කි. 20 44 20 20 8 2 8 2 8 2 8 2 8 2 8 2 8 2 8 2 8 2 8	9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9	4, 512 6, 962 6, 954 10, 243 11, 117	5, 163 7, 831 7, 018 6, 865 11, 352 12, 040	7,756 7,756 10,1863 11,883 11,883	88.88.88 112.11 112.11 113.11 113.11 113.11
Mattinger, Anty Cape Henry, Va. Lynchenger, Va. Lynchurg, Va.										9.4.9.9.4.0.7.17.0.7.19.17.0.7.15.17.0.7.15.17.0.7.15.17.17.17.17.17.17.17.17.17.17.17.17.17.			
South Atlantic Sates: Charlotte, N. C. Hatterra, N. C. Kitty Hawk, N. C. Kitty Hawk, N. C. Smith Fille, N. C. Vilmington, N. C. Charleston, S. C. Augusla, Ga. Savannah, Ga. Savannah, Ga.	10, 402 11, 995 10, 464 10, 653 6, 623 6, 575 7, 574 8, 574 8, 574 8, 574 8, 574 8, 574 8, 574 8, 574 8, 574 8, 574 8, 574 8, 574 8, 574 8, 574 8, 574 8, 574 8, 574 8, 574 8, 574 8, 574 8, 574 8, 574 8, 574 8, 574 8, 574 8, 574 8, 574 8, 574 8, 574 8, 574 8, 574 8, 574 8, 574 8, 574 8, 574 8, 574 8, 574 8, 574 8, 574 8, 574 8, 574 8, 574 8, 574 8, 574 8, 574 8, 574 8, 574 8, 574 8, 574 8, 574 8, 574 8, 574 8, 574 8, 574 8, 574 8, 574 8, 574 8, 574 8, 574 8, 574 8, 574 8, 574 8, 574 8, 574 8, 574 8, 574 8, 574 8, 574 8, 574 8, 574 8, 574 8, 574 8, 574 8, 574 8, 574 8, 574 8, 574 8, 574 8, 574 8, 574 8, 574 8, 574 8, 574 8, 574 8, 574 8, 574 8, 574 8, 574 8, 574 8, 574 8, 574 8, 574 8, 574 8, 574 8, 574 8, 574 8, 574 8, 574 8, 574 8, 574 8, 574 8, 574 8, 574 8, 574 8, 574 8, 574 8, 574 8, 574 8, 574 8, 574 8, 574 8, 574 8, 574 8, 574 8, 574 8, 574 8, 574 8, 574 8, 574 8, 574 8, 574 8, 574 8, 574 8, 574 8, 574 8, 574 8, 574 8, 574 8, 574 8, 574 8, 574 8, 574 8, 574 8, 574 8, 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Florida Peninsula: Codar Keys, Fla Key West, Fla Sanford, Fla											5, 632 8, 624 767		

Average movement of the wind at stations of the Signal Service, United States Army, for each month and the year—Continued.

Districts and stations.	January.	Febru- ary.	March.	April.	May.	June.	July.	August.	Septem- Ver.	October.	Novem- ber.	Decem- ber.	Annual.
Eastern Gulf States:	Miles.	Mües.	Miles.	Miles.	Miles.	Miles.	Milas.	Kiles.	Miles.	Miles.	Miles.	Miles.	Miles.
Atlanta, Ga			8, 210			5, 368			5.762			7.504	
Pensacola, Fla			6, 206			5, 604			4, 778			200	
Monformary Ala	<b>4</b> , 653	98	2,096	500	÷.	3,	986	88	4, 180	4, 53	4.624	3	58,823
Vicksburg, Miss			- L			2000			8,248			3,54	
Now Orleans, La.			6, 273			4,224			2,0			÷.	
Western Gulf States:						;			:			5	
Shreveport, La.				4, 637								3,756	
Tittle Deals Ask												4,840	
Galveston, Tex	2,5	7,380	, c	¥.6	2,744	96	121	2,002	20.0	8,53	3, 672	4, 137	
Indianola, Tex												25,00	
Palestine, Tex												7,910	
Rio Granda Valley.												3,96	89, 607
Brownsville, Tex		_											
Rio Grande City, Tex	5,027	5, 180	6, 550	6,618	6,861	6,015	7, 723	5.00	9 6	4,805	28.7	D, 414	62, 251 68, 251
Ohio Valley and Tennessee.													
Chattanooga, Tenn										3, 584			
Mountly Tonn										3,265			
Nashville, Tenn	, e	600	4, 885	4, 0	250	9,0	200	2003	2,243	9,680	4, 211	÷.	47,846
Louisville, Ky										2,25			
Greencastle, Ind										1,017			
										8 703			
Cincinnati, Obio										5,380			
Dittahang Da										4, 679			
Lower Lakes:										3,941			
Buffalo, N. Y												,	
Oswego, N. Y.												0,173	
Rochester, N. Y												57 'a	
Classian Otto												9	
Sandusby Ohlo												24.	
												10, 234	
Douote, Mich.	2.0	5, 916	6.807	900	5,007	2,5	9004	3, 4	2000	522	0000	6, 891	74, 882
Upper Laken:												770 5	
	6,945	6, 765	7, 593	6, 766									
Escapada, Mich													
Macking City, Mich				e 603	7,850	6, 448	c, 264	6,000	7, 161	8, 670	8,805	9, 123	93, 501

Marguette, Mich. 7. Pot Haron, Mich. 7. Chicago, III. 8. A. Mayarkee, Wis. 8. Delath, Minn. 4.		Leavenworth, Kans Leavenworth, Kans Omala, Nebr. Bennett, Fort, Dak. Huron, Dak Yankton, Dak Yankton, Dak Wankton, Dak Wanchand Missel	Saloteness attan 7. Sinte Vincer, Minn 7. Bismack, Dak 8. Totten 7. Totten 8.	Assinabolno, Fort, Mont Benton, Fort, Mont Benton, Fort, Mont Barrens, Mont Barrens, Mont Boylar River, Mont Boylar River, Mont Bollaw, Fort, Mont Benton Bordwood, Dak Boylar River, Mont Bordwood, Dak Boylar River, Mont Bordwood, Dak Boylar River, Mont Bordwood, Dak Boylar B	Denver Colo Piles Peak, Colo Piles Peak, Colo Piles Peak, Colo Net Las Animas, Colo Boldge City, Kans Ellott, Fort, Tex Sill, Fort, Tex Coucho, Fort, Tex Coucho, Fort, Tex Davis, Fort, Tex	Stockton, Fort, Tex.
742 6,062 741 6,026 939 8,205 877 5,102		8339 4548 5725 2523 348 66,4,6	157 6,393 769 5,720 198 5,164 450 7,987	270 252 252 264 264 264 265 265 265 265 265 265 265 265 265 265	867 4, 307 186 16, 643 214 5, 485 110 7, 742 130 7, 685 206 6, 885 308 6, 160	186
25 25 27,7,834 5,95,504 14,110 5,814	6 472 6 472 6 5 472 6 6 473 1 4 7 83 1 7 4 50 1 7 4 50 1 8 8 2 2 3 4 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8	වේශ්වේඛ්ශ්ශ් ශ	8 6 7 7 8 8 9 5 4 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	11 10 10 10 10 10 10 10 10 10	25 5 44 16	
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73, 736 82, 807 73, 272 96, 920 63, 845				91, 625 54, 139 64, 738 97, 946 56, 396 51, 464 93, 225 97, 154	55, 928 178, 892 170, 253 169, C07 98, 192 50, 550	_

drerage movement of the wind at stations of the Signal Service, United States Army, for each month and the year-Continued.

Districts and stations.	Јаппълу.	Febru.	March.	April.	May.	June.	July.	August.	Septeti- ber.	October.	Novem- ber.	Decem- ber.	Annual.
Southern Plateau;	Miles	Miles.	I	Miles.	Milas.	Miles.	Miles.	Miles.	Miles.	Miles.	Mil	Miles.	Müce.
Danus Fe, N. Mex. El Paso, Tex	v. w	. 857 943 943	2. 4. 82.0. 82.0.	€ 4 88 88 88	æ 4.	3,342	8, 949 876	2, 579 643	4, 4, 5, 2,	4, 867		3,388	60, 871 80, 871
Apache, Fort, Aris.	220,	3,919		5,72	5, 676	5, 416	\$	8	4, 159	4,883	20-	3, 750	55, 145
Prescott, Aria	8,4	4, 132		0,245 244	6.00 6.00 6.00 6.00 6.00 6.00 6.00 6.00	0, 10, 0, 14, 0, 14,	4,4	3, 6, 6, 7, 7, 7, 7, 7, 7, 7, 7, 7, 7, 7, 7, 7,	. e.	4,020	e co	3, 629	12 3 <b>3</b>
Yuma, Aris	12 <b>7</b>	4, 425		4, 623	. 200 200	3, 740	4, 507	4, 153	2, 978	3, 315	ຄວ້	3, 728	47, 94
Winnemucca, Nev Salt Lake City Utah	6, 548	6, 251	6, 897	6, 280	6, 236	4.854	6,850	6, 239	5, 940 915	6, 161	10.00	6,408	72, 805 45, 680
Northern Plateau: Boisé City Idaho	810	666	8	81.4	4 973		26	2 787		9 900	9 704	9 611	39.47
Lewiston, Idaho				200	2,173		2,5				1,744	153	
Spokane Falls, Wash	2,84	8, 880 174	*, e,	÷ ÷	* * * * * * *	8,6,6 12,6,6	× × × × × × × × × × × × × × × × × × × ×	200 200 200 200 200 200 200 200 200 200	9 9. 146	2,951	2, 609	2, 722	, 8 , 8 , 8 , 8
North Pacific Coast: Canby, Fort, Wash					6. 214		. 500				10, 135	9,653	
Olympia, Wash				27.28 25.58	25,783							3,028	
Portland, Oreg	28	3,425	8	338	25	908	1 8 1	3	8	3,020	8,233	3,400	9
Middle Pacific Coast:				2, 457	2, 512							1, 662	
Cal.	13,	14, 266			12, 804	11, 743		16, 141		11, 499	14, 740		
Sacramento, Cal	4, 4, 833	4 €	5,4 419	4 5	4 to	6 4 66 4	4, 520 5, 270	2 4 2 8 2 8	4,416	3,837	3,580	4, 553	57,73
San Francisco, Cal	'n	7.85			8,866	990,6		8		5,710	4, 488		
	4,270	4,048	18	8 8	3, 932	8, 719	8, 552	8, 963	3,270		3,641	3,947	45,000
San Diego, Cal		4, 106					4,714			3, 998			
Saint Michael's, Fort.		8, 387	9, 341				8, 428						
Unalyshka	9,079	9.9.	9, 9, 8, 8, 8, 8, 8, 8, 8, 8, 8, 8, 8, 8, 8,	20. 20. 20. 20.	2.5.	, r.	4.5.	o.	i i i i i i i	8, 997	6 5 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6	10,007	106, 492
Denring a Island, Behring Des.		11,029	10,716										

1 Station closed December 31, 1885.

*Station closed November 30, 1885.

# APPENDIX 52.

Average cloudiness, scale of 0 to 10, at stations of the Signal Service, United States Army, for each month and the year; computed from the commencement of observations at each to December, 1885, inclusive, from the tri-daily telegraphic observations.

[The monthly average is obtained by dividing the sums of the amount of cloudiness recorded daily by the number of observations taken.]

Districts and stations.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Annual.
New England:  Rastport, Me Portland, Me Mount Washington, N. II Boston, Mass Block Island, R. I New Haven, Conn New London, Conn	4. 9 6. 2 5. 4 5. 3 5. 4	5.4 4.7 5.9 4.8 4.7 4.9 4.6	6, 1 5, 5 6, 3 5, 5 5, 0 5, 4 5, 1	6.0 5.4 6.1 5.5 4.4 5.1	5.8 5.3 5.7 5.2 4.9 5.1 4.6	5.8 4.9 5.8 4.9 3.6 4.7 4.4	5.6 4.7 5.9 5.0 4.0 4.8 4.6	5.0 4.4 5.6 4.6 4.4 4.8 4.6	5. 2 4. 6 5. 6 4. 6 4. 4 4. 6 4. 5	5.6 5.1 5.8 4.9 4.7 4.6 4.5	6.3 5.1 6.1 5.2 5.2 5.0 4.9	6.1 5.3 5.5 5.5 5.5 5.5 5.1	5.7 5.9 5.1 4.7 5.7
Middle Atlantio States: Albany, N. Y. New York City. Philadelphia, Pa Atlantio City, N. J. Barnegat City, N. J. Cape May, N. J. Sandy Hook, N. J. Baltimore, Md Washington City. Cape Henry, Va Chincoteague, Va Lynchburg, Va	5.7 5.5 5.7 5.5 5.5 6.9 5.0 5.0 5.0 5.0 5.0 5.0 5.0 5.0 5.0 5.0	5.6 5.1 5.2 5.4 5.4 4.6 5.2 5.3 5.6 5.1 4.8 5.3	6. 0 5. 4 5. 5 5. 7 5. 6 5. 0 5. 4 5. 4 5. 5 5. 1 5. 0 4. 8 5. 1	5.8 5.4 5.3 5.4 5.4 5.5 5.3 5.4 5.0 4.8 5.1	5.2 5.0 4.9 4.9 4.1 4.7 4.9 4.4 4.6 4.4	4.8 4.7 4.7 4.5 4.7 4.1 4.4 4.9 4.8 4.8	4.9 4.6 4.7 4.8 4.6 4.9 4.6 4.7 4.6 4.8	5.1 4.9 4.7 4.8 4.7 4.5 5.0 4.9 5.1 4.7 5.0	4.9 4.5 4.4 4.6 4.7 4.0 4.6 4.5 4.5 4.7	5.7 4.7 4.5 4.6 3.9 4.5 4.7 4.2 4.4 3.9	6.8 5.2 5.0 5.2 5.1 5.1 4.9 5.1 5.0 4.5	5.1 5.6 5.3 5.7 5.3 5.1 4.7	5.6 5.1 5.1 4.6 5.1 5.2 4.7 4.6
Noriotic, Va. South Atlantic States: Charlotte, N. C. Hatteras, N. C. Kitty Hawk, N. C. Macon, Fort, N. C. Smithville, N. C. Wilmington, N. C. Charleston, S. C. Augusta; Ga. Navannah, Ga. Jacksonville, Fla. Florida Peninsula:	6.4 5.9 5.4 6.2 5.4 5.4 5.0 5.1	5.2 4.9 4.9 5.0 4.8 5.2 4.6 4.8 4.8	5. 1 4. 9 4. 9 4. 9 4. 5 4. 6 4. 3 3. 9	5. 2 4. 8 4. 9 5. 2 4. 5 4. 6 4. 2 4. 5 4. 4	5.0 4.4 4.3 4.6 3.8 4.9 4.1 4.1 4.3	4.8 5.1 4.7 4.3 5.3 4.4 4.9 4.8 4.7 4.9	5.0 4.3 4.5 4.5 5.0 4.7 4.5 4.7 4.7	5. 1 5. 1 5. 2 5. 3 4. 9 5. 4 5. 0 5. 1 4. 4	4.7 4.4 4.5 4.0 4.6 5.0 4.8 4.9 4.7	4.6 4.5 4.4 4.1 4.2 4.1 3.7 3.8 4.1 4.3	4.8 4.6 5.1 4.9 4.6 4.5 4.9 4.3 4.7 4.6 4.6	4.9 5.1 5.1 5.0 4.7 5.0 4.6 4.8 4.6	5. 1 4. 8 4. 8 4. 9 4. 6 4. 9 4. 6 4. 6 4. 6 4. 6
Cedar Keys, Fla	4. 2 5. 4	3.6 3.5 4.2	8.7 2.9 4.2	3. 5 8. 1 8. 5	3.8 4.3 4.2	4.8 4.9 5.5	4.6 4.9 4.0	4.9 5.0 4.3	3.7 5.2 5.0	3.3 4.6 4.5	3. 8 4. 0 4. 5	4.0 4.1 3.8	4.0 4.2 4.2
Atlanta, Ga Pensacola, Fla Mobile, Ala Montgomery, Ala Vicksburg, Miss New Orleans, La Wastern Gulf Strees	5. 8 5. 4 6. 2 5. 8	5.3 4.8 5.0 5.4 5.4 5.0	4.9 4.3 4.7 4.7 4.9 4.9	4.8 4.7 4.8 4.8 4.5 5.0	4.6 4.4 4.3 4.4 4.3 4.6	5.1 4.5 4.8 5.0 4.0 4.5	4.6 4.7 4.9 4.9 4.2 4.9	5.2 4.9 4.8 4.9 4.0 4.7	4.3 4.2 4.5 4.5 4.6	4.4 4.3 4.0 4.3 3.8 4.1	4.7 4.5 4.8 4.7 4.8	5.2 5.0 5.5 5.3 5.4	5.0 4.7 4.7 4.9 4.6 4.8
Western Gulf States: Shreveport, La Fort Smith, Ark Little Rook, Ark Galveston, Tex Indianola, Tex Palestine, Tex Ean Antonio, Tex	4.9 5.6 5.5 5.4 5.6	5.5 5.7 5.6 5.4 5.6 5.5 5.3	5. 2 5. 1 5. 2 5. 2 5. 6 5. 3 5. 0	5.0 5.2 4.6 4.9 5.0 5.6 4.7	4.7 4.7 4.8 5.0 5.0 5.3	4.5 4.3 3.8 4.0 3.9 4.2 4.3	4.1 4.1 8.9 3.9 8.7 4.1 4.4	3.6 4.1 3.5 4.1 3.7 3.6 4.0	3.8 3.9 3.7 4.1 3.9 4.0 4.0	3.9 4.4 4.0 3.7 3.7 4.1 4.1	4.6 4.4 4.6 4.6 4.6 4.6	5.8 5.0 5.0 5.2 5.4 5.1 5.0	4.7 4.7 4.5 4.6 4.6 4.8 4.4
Rio Grande Valley : Brownsville, Tex Rio Grande City, Tex	5. 8 5. 4	5. 7 4. 6	5. 8 5. 2	5. 4 4. 2	4. 9 4. 3	3. 8 3. 4	3.7 2.9	4.5 4.1	4. 7 3. 8	4. 8 4. 2	5. 4 4. 8	5. 6 4. 6	41

¹ Station closed December 31, 1885,

²Station closed October 31, 1885.

Average cloudiness, scale of 0 to 10, at stations of the Signal Service, &c.—Continued.

Districts and stations.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Annual.
Ohio Valley and Tennessee:					-						_		_
Chattanoora, Tenn	6.2	5.7	5.2	5.0	4.4	4.4	4.2	4.8	4.4	4.7	4.7	5.7	5.0
Knoxville, Tenn	6.3	5.7	5. 2	5.0	4.4	5.0	4.6	4.6	4.1	4.0	5.3	5.4	5.0
Knoxville, Tenn Memphis, Tenn Nashville, Tenn	5.9 6.5	5.8 6.1	5.1 5.7	5.0	4.7 5.0	4.3	4.3	4.0	4.0	4.0	5.2	5.7	4.8
Louisville Kv	6.2	5. 9	5. 9	5. 5 5. 4	4.8	5. 2 5. 3	4.6	4. 8 3. 9	4.5	4.2	5.4 5.6	6.3 6.2	5.4
Louisville, Ky	5.7	4.7	6.0	5. 9	4.9	4.7	3.7	4.0	4.5	4.1	5.4	6.8	5.2
Indianapolis, Ind	6.2	5.8	6. 1	5.6	4.9	5.3	4.6	4.1	4.0	4.6	5.8	6.4	5.3
Cincinnati, Ohio	6.3	6.0	5.9	5.3	4.5	5.1	4.4	4.2	4.2	4.4	5.8	6.4	5.2
Indianapolis, Ind	6.8 7.0	6.4	6.4	5. 5 5. 6	4. G 5. O	5. 2 4. 8	4.4	4.2	4.3 5.0	4.9 5.4	5.7 6.6	7.3 7.2	5.5 5.8
Lower Lakes:		i	""	1	""	""							-
Buffalo, N. Y. Oswego, N. Y. Rochester, N. Y. Erie, Pa. Cloveland, Obio.	7.7	6.5	6.3	5.6	5. 2	4.9	4.7	4.5	5.0	6.0	7.5	8.2	6.0
Oswego, N. Y	7.9	7.3	6.9	5.7	5. 1	4.9	4.8	4.7	5.2	6.4	8.1	8.7	6.3
Reio Po	7.6	6. 9 6. 6	6.8	5. 6 5. 5	4.9	4.7	4.6	4.5	4.9	6.0	7.8	8.4 8.3	5.9
Cleveland, Obio	7. 3	6.4	6.5	5.4	4.6	4.5	4.4	4.2	4.9	5.6	7.3	7.6	5.7
53B4U8KY, OBO	U. O	6.3	6. 2	5. 5	4.7	4.6	4.2	4.2	4.4	5.4	6.6	7.5	5.5
Toledo, Ohio	6.9	6.3	6.3	5.7	5.0	5.0	4.6	4.8	4.5	5.5	6.6	7.3	5.7
Detroit, Mich Upper Lakes:	6.9	6. 0	6.2	5.4	4.9	4.9	4.3	4.1	4.3	5.1	6.4	7.0	5.5
Alpena, Mich	7.1	6.2	5, 8	4.8	4.8	4.6	4.2	4.2	5. 2	6.1	7. 3	7.8	5.7
Escanaba, Mich	6.2	5.8	5, 5	5.2	5. 2	4.9	4.5	4.8	5. 2	6.4	7.2	6.9	5.7
Grand Haven, Mich	8.0	6. 5	6. L	5.1	4.4	4.5	3.8	3.7	4.3	5.5	7.4	8.1	5.6
Mackinaw City, Mich Marquette, Mich	7. 0 6. 7	6. 3 6. 1	4.9 5.3	5.3 5.2	5.3	4.8	4.8	4.5	4.8 5.7	6.4	7.9 7.3	8.7	5.9
Port Haron, Mich	7.0	6. 1	6.3	5.5	4.7 5.1	4.7	4.5	4.5	4.8	6.1	6.9	7.4	5.7 5.8
Chicago, Ill	5.6	5, 5	5.8	5. 3	4.6	5. 1	4. Q	3.8	4,3	5. 2	5. 9	6.0	5.1
Milwaukee, Wis		5.8	6.0	5.6	5.1	5. 2	4.5	4.5	4.9	8.5	6.4	6.8	5.5
Duluth, Minn. Upper Mississippi Valley: Saint Paul, Minn La Crosse, Wis Davenport, Iowa Des Moines, Iowa Dubunus Iowa	4.9	5.4	5.0	5.2	5.1	5.3	4.7	4.9	5. 3	6.1	6.3	5.8	5.4
Saint Paul, Minn	4.8	4.8	5. 2	5.3	5. 2	5.0	4.3	4.6	4.8	5.1	5.8	5. 1	5.0
La Crosse, Wis	4.8	4.8	5.2	4.7	4.9	4.8	4.8	4.3	4.4	5.0	5. 9	5.4	4.9
Davenport, Iowa	5.4	5.4	5.0	5.6	5. 1	5, 2	4.5	4.3	4.5	5.0	5.8	6. 1	5.2
Des Moines, Iowa	4.8	5.1	5.3	5.8	5.7	5.7	4.8	4.6	4.6	4.9	4.8	6.0	5. 2
Keokuk, Iowa	7	5.3 4.8	5. 9 5. 4	5. 4 5. 2	5. 4 5. 2	5. 6 5. 3	4.6	4. 4 3. 9	4.9 3.9	5. 5 4. 5	6.1 5.4	6.2 5.7	5.4 4.9
Cairo, Ill	6.0	5.6	5.3	5.3	4.9	5.0	4.4	3.8	4.2	4.3	5.6	6.2	5.1
Springfield, Ill	5.5	5.0	5.4	5.4	4.8	5. 5	4.0	3.7	3.9	4.5	5.0	6.2	4.9
Missouri Valley:	5.4	5.3	5.4	5. 2	5.0	5.1	4.4	3.7	3.7	4.0	5.3	5.9	4.9
Leavenworth Kans	4.9	4.9	5. 0	5.3	5.4	4.6	4.3	3.7	4.0	4.1	4.6	5.3	4.7
Leavenworth, Kans Omaha, Nebr	4.0	4.8	5.3	5.5	5.7	5.0	4.5	4.2	4.0	4.2	4.6	5.3	4.8
Bennett, Fort, Dak.	4.6	5.0	5. 5	5.6	5.4	4.8	4.7	4.2	4.0	4.7	4.6	5.1	4.9
Huron, Dak Yankton, Dak	4.2	4.6	5.6	5.3	4.9	4.4	4.4	4.1	4.0	5.1	4.5	4.7	4.7
		4.9	5. 1	4.9	5. 4	4.6	4.2	3. 9	3.8	4.3	4.3	4.8	4.5
Extreme Northwest:  Moorhead, Minn  Saint Vincent, Minn  Bismarck, Dak  Buford Fort Dok	4.2	4.8	5.4	4.9	5. 2	5. 1	4.8	4.3	4.5	5.5	5.8	5.2	5.0
Saint Vincent, Minn	4.0	4.4	4.8	4.7	4.5	4.6	4.7	4.1	4.4	5.7	5.9	4.3	4.7
Buford, Fort, Dak	4.3	4.9	5.6	5.6	5.5	4.8	4.1	3.5	3.8	4.7	5.1 5.5	5.8	4.8
Totten, Fort, Dak	2.8	4.6 3.4	5. 3 6. 2	5.0 6.1	4.8	5. 0 5. 0	4.4	3.7 4.2	4.1	5.4	5.4	5. 1 5. 2	5.0 4.7
Northern Slope:	1	•••			[	0.0				~-			
Assinaboine, Fort, Mont	5.6	5. 2	4.7	4.3	4.3	3.9	3.6	3. 2	3.7	4.6	4.9	5.0	4.2
Benton, Fort, Mont		5.6	4.7	4.9	4.7	4.5	3.4	2.8	4.2	5.3	5.3	5.8	4.8
Helena Mont	6.4	5.7 5.6	4.9	5.3 4.6	5. 3 4. 9	4.7	4.0 3.4	3.0 2.8	3. 6 3. 5	4.7	4.6	5.8 5.0	4.8 4.6
Itelena, Mont. Maginnia, Fort, Mont. Poplar River, Mont. Shaw, Fort, Mont. Deadwood, Dak. Cheyonne, Wyo. North Platte, Nebr	6.7	6.0	5. 3	5. 2	5. 2	5.0	4.0	3.3	4.4	4.8	5.1	5.5	5.1
Poplar River, Mont	4.4	4.4	4.7	4.0	3. 2	3. 1	3.4	2.9	3.1	4.1	4.4	4.8	4.6
Shaw, Fort, Mont	5.5	4.9	4.1	4.4	4 5	4.4	8.4	3.1	3.8	4.5	4.6	4.8	4.3
Cherenne Wvo	3.4	4.7 3.4	4.8	5.2 4.9	5. 2 5. 2	4.7 3.9	3.4	8.1 8.7	3.7	3.8	4.0 3.6	4.5 8.8	4.2 3.9
North Platte Nebr	4.0	4.3	5.0	5.0	5.6	4.5	4.1	8.9	3.7	4.1	4.1	4.6	4.4
Ariumo Siopo.		l		l	l	l			1	ŀ	1		
Denver, Colo	3.2	3.5	4.0	4.9	5.0	3.7	4.1	4.2	3.1	8.4	3.3	8.4	3.8
West Las Animas, Colo	3.7	4. 2 8. 4	4.5 3.5	4.8	4.7 5.4	3. 8 4. 0	4.8	4.7 4.0	3. 6 3. 0	3.6 3.3	3.4 3.0	8.7 4.2	4.1
Dodge City, Kans	4.0	4.0	4.0	4.0	4.0	8.6	4.1	3.4	3.0	3.2	3.7	4.1	1.8
Elliott, Fort, Tex	3.2	3. 2	3. 5	3.5	4.5	3. 6	3.7	3.4	3.1	8.4	8.0	2.4	2.5
7 44 - 01	امدا			۱ ا	۱	ا ـ ـ ا	۱			ا ا	ا ۾ ا	امما	
Southern Slope:		4.6	4.1 3.8	3. 6 3. 3	4.6	3.7	3.5	3. 2 3. 7	3.6 4.3	8.5 4.4	8. 9 3. 9	4.6	4.9
Southern Slope:	4.0	141			7.4	0.0			7.0				'
Southern Slope: Sill, Fort, Ind. T Concho, Fort, Tex. ²	4.0 8.4	4. 1 3. 2	3.5			3, 1	3.5	8.6	8.4	3.3	8.2	3.1	2.2
Southern Slope: Sill, Fort, Ind. T Concho, Fort, Tex. Davis, Fort, Tex Stockton, Fort, Tex	4.0 8.4 3.1			2.7	2.8 3.2	3. 1 2. 9	3. 5 3. 0	8.6 3.0	8.4 2.8	2. 8	8.2 2.9	3. 1 8. 8	2.7 2.2 3.1
Southern Slope: Sill, Fort, Ind. T Concho, Fort, Tex. Davia, Fort, Tex Stockton, Fort, Tex Southern Plateau.	8.4 3.1	3. 2 3. 4	3. 5 3. 2	2.7 2.8	2. 8 3. 2	2.9	3.0	3.0	2.8	2.8	2.9	8.8	8.1
Southern Slope: Sill, Fort, Ind. T Concho, Fort, Tex. Davis, Fort, Tex Stockton, Fort, Tex	8.4 3.1	3. 2 3. 4	3. 5 3. 2	2.7 2.8	2. 8 3. 2	2.9	3.0						2.7 2.7 2.1

¹Station closed November 30, 1885.

²Station closed September 15, 1885.

Average cloudiness, scale of 0 to 10, at stations of the Signal Service, &c.—Continued.

Districts and stations.	January.	February.	March.	April	Мау.	June.	July.	August.	September.	October.	November.	December.	Appual.
Southern Plateau—Cont'd:	3.3			2.2	2.0								
Grant, Fort, Ariz Prescott, Ariz		3. 6 2. 7	3. 5 8. 2	2.7	1.8	2. 2 1. 5	4.9	4.7 3.4	2.0	1.6	2.2	3.0	3.0
Thomas, Fort, Ariz	3.4	3.6	3.6	2. 2	1.8	2.2	3.1	4.1	1.7 2.2	1.6	1.8 2.4	2.7	2.4
Yuma, Ariz	2.4	2.2	2.4	1.7	i.i	1.0	1.6	2.3	1.0	1.3	1.8	2.8	2.9 1.7
Middle Plateau:	٠.٠	۵.۵	۵. •	1.1	1	1.0	1.0	2.3	1.0	1.3	1.0	2.2	1. 1
Winnemucca, Nev	4.5	4.8	3.9	4.4	4.2	3.2	1.6	1.4	1.9	2.5	3.8	4.3	3.4
Salt Lake City, Utah	5.3	5.4	5.1	5. 3	4.6	3. 2	2.6	3.1	2.7	3.9	4.6	5.6	4.3
Northern Plateau:	0.0	~ -	~-	0.0	""	0.5		0.1		3.5	7.0	J. U	7. 5
Boisé City, Idaho	5, 7	6.2	4.9	4.8	4.8	4.1	2. 5	2.0	3.0	4.3	4.8	6.0	4.5
Lewiston, Idahol	6.7	5.8	4.4	4.4	4.4	4.5	2.7	2.0	3. 1	4.6	5.6	6.6	4.6
Dayton, Wash ²	6.4	5.8	4.4	4.7	4.6	4.6	2.8	1.9	3.5	4.8	5. 5	7.0	4.7
Spokane Falls, Wash	6. 2	6. 1	4.4	4.4	4.8	5.1	3.6	2.0	3.8	5. 3	6. 2	4.6	4.6
Month Danisla Const.										1		1	
Canby, Fort, Wash	5.2	5.0	4.9	4.9	6.4	7. 2	6.4	4.1	5.0	5.0	6.0	6. G	5. G
Olympia, Wash	17.9	7.2	6.3	6.3	6.1	6.0	4.6	4.3	5. 2	6.4	7.5	7.7	6.3
Tatoosh Island, Wash	7.2	6.8	6.0	5.6	6.0	7.1	5.6	4.0	7.0	5.7	7.8	7. 2	6.4
Portland, Oreg	7.1	7.3	6.8	6.3	6.5	5, 8	3.9	3.7	4.3	5.7	6.7	7.2	6.0
Roseburg, Oreg	7.0	6.8	5. 5	5.7	5.1	4.9	3.0	2.1	3. 2	5.3	6.2	6.7	5. 1
Middle Pacific Coast:	l			l	1	l		ĺ		ļ		l	l
Cape Mendocino, Cal	5.3	4.1	4.6	5.6	4. 2	3.9	2. 5	1.5	2.4	3.8	4.8	4.8	4. l
Red Bluff Cal	4.4	4.4	3.7	4. 1	3.3	1.8	1.0	0.5	1.0	2.1	3.3	4.4	2.8
Sacramento, Cal	4.3	4.1	3.6	3.6	2.5	1.4	0.5	0.4	0.0	1.9	3.0	3. 1	2.5
San Francisco, Cal	4.8	4.7	4.7	4.2	3.8	4.1	4.7	4.3	3.4	3.3	3.8	4.4	4.1
South Pacific Coast:			١		١. ـ	١. ـ			l	۱			
Los Angeles, Cal	3. 1	3.8	4.4	4.7	4.3	4.3	2.9	2.6	2.3	2.5	2.5	3. 2	3.4
San Diego, Cal	3, 9	4.3	4.8	4.5	5. 3	5.0	4:6	4.0	3. 5	3. 7	3.5	3.8	4.2
Alaska Stations:						۱	۰.	۱	۱	۱	امما		۔ ۔ ا
Saint Michael's, Fort	6. 1 7. 2	4.3 6.2	5.6	6.8	7.3	7. 4 6. 9	7. 8 8. 0	8.2	8.2	7.7	6.3	5. 3	6.7
Sitka Unalashka	8.6	8.6	6. 1 7. 9	8.5	8.2	8.6	7.7	6.5	7.0	7.0	7.6	6.7	7.0 8.0
Behring's Island, Behring	8.8	8.6	9.0	8.6	7.5	7.5	6.3	7.7	8.4	8.5 7.6	7.7	8.0	8.0
Sea.	0.0	0.0	υ. υ	0.0	1 3	1.3	0. 3	1.3	امن	7.0	1.7	ا ما	0.0
Don.	1		I	l	l		l	l	l	1		l	1

¹ Station closed December 31, 1885.

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² Station closed November 30, 1885.

### APPENDIX 53.

Average number of clear, fair, and cloudy days at stations of the Signal Service, United at each to December, 1885, inclusive,

[Cloudiness is recorded on a scale of 0 to 10, each observation. Clear days

	J:	anua	ry.	Fe	bru	ry.	2	Marc	h.		Apr	I.		May	
Districts and stations.	Clear.	Fair.	Cloudy.	Clear.	Fair.	Cloudy.	Clear.	Fair.	Cloudy.	Clear.	Fair,	Cloudy.	Clear.	Fair.	Cloudy.
New England:	U.														
Eastport, Me Portland, Me	7.3		11.8	6. 9	11.1	10.3	6. 0	11. 2	13.8	7.0	9, 1	13.9	6.7	11.3	13.
Portland, Me	9. 7	12.1	9. 2	9.3	11.5	7.5	7. 1	12.4	11.5	8, 1	11. 1	10.8	8.2	12.2	10.
Mount Washington, N. H	5.7	10. 9	14.4	6. 9	9. 1	12.2	6. 9	9.1	14. 2 12. 5 7. 4	7.2	9. 2	13. 6	7.7	12.2	11.
Block Island, R. I	7.9	10, 4	12.7	8, 9	9.1	10. 3	8.5	10, 0	12.5	7, 5	11.3	11, 2	7.7	14.1	9.
Block Island, R. I	8.4	14. 2	8.4	9. 0	14.0	5. 2	10. 0	13.0	7.4	11. 6	11.0	0.8	10.4	13. 6	1 7
New Haven, Conn									10.5						
New London, Conn	9. 0	13. 3	8. 7	10. 5	10.7	7.0	9. 0	12, 2	9.2	8. 9	12. 9	8.1	10. 2	13.0	17.
Albany, N. Y		10 7	10.0	~ 0	10.0	100	0 0	10 1	11.6	0.1		in e	00	100	
		19 1	11. 3	7 0	11.0	0.5	7 0	13. 1	9.9	8 9	19 6	0.0	0. 1	10.0	8.
Philadelphia Pa	6.4	19.3	19 9	7 4	10 0	0.0	7.5	11 6	11.9	8 0	11 0	10.1	10.6	11.0	8
Atlantic City N J	7.6		11.8						9.7						
Philadelphia, Pa. Atlantic City, N. J. Barnegat City, N. J. Cape May, N. J. Sandy Hook, N. J.	7.0	10 5	11 5	7 7	11 0	0.2	6. 7	24 4	0 0	12 5	10 0	10 8	0 5	TE C	1 6
Cana May N J1	10 4	10.2	10 4	10 9	8.5	0.5	9.6	10.3	11 1	10.4	0.3	10. 3	13 6	10.	17
Sandy Hook N. J	7.8	19.5	10.7	8 4	11.6	8.2	7.1	15.0	8.9	7.8	11.0	10.3	0.5	14.5	7
Baltimore, Md	7.3	13. 1	10.6	7. 5	12.8	8.0	8.4	12. 1	10. 5	7. 7	12 1	9. 7	10. 2	12.0	8
Washington City	5.9	12. 2	12.9	6. 7	11.8	0.7	7. 3	12.6	11. 1 8. 9 10. 5 10. 8 9. 9	8. 1	12.5	9.5	10.4	12.1	8
Cape Hepry Va	7.3	11.3	12.4	8 4	11.3	8.5	8. 7	12.4	9.9	10. 3	10. 4	9.3	11.7	12.3	7
Chincoteague, Va	6. 2	13. 6	11. 2	6.4	14. 6	7.2	8, 8	13, 4	8, 8	9. 5	12. 8	8.0	9.5	13, 2	8
Lynchburg, Va	8.7	11.7	10.6	9. 1	11. 2	8.0	11, 5	11.0	8.5	10, 1	11.6	8.3	12.4	11. 2	7
Chincoteague, Va	8.5	11. 4	11.1	8.5	10. 9	8.9	9. 6	11.3	8.8 8.5 10.1	9.8	10. 3	9. 7	10. 6	12.5	7
		1	200	44.3	1	100	100	100	1	100	1	100	100	1	16
Charlotte, N.C	6. 0	10, 6	14.4	8.7	8.9	10.7	9. 0	13. 4	8.6	9.1	11.9	9.0	9.7	12.7	8
		13. 6	11.6	8.4	12,0	7.8	9. 6	11. 6	9, 8	8.8	13.8	7.4	9. 6	14. 6	6
Kitty Hawk, N. C	8.8	12.4	9.8	9. 5	10, 2	8.6	10. 3	11.8	8. 9	9, 9	12.7	7.4	12.0	12 6	6
Kitty Hawk, N. C. Macon, Fort, N. C. Smithville, N. C. Wilmington, N. C.	5. 2	13. 4	12.4	8.8	10.4	9. 0	10.0	12. (	9. 0 9. 3 10. 0	9, 6	10. 2	10.2	8.8	16. 2	0
Smithville, N. C	7.3	12, 0	11.7	9, 4	9, 3	9.6	10. 8	10, 5	9, 3	10.0	11.7	8.3	12.1	13. 4	.5
Wilmington, N. C	8.6	10. 9	11.5	8, 7	8.3	11. 2	11.3	9. 7	10.0	11.	10.0	7.6	10. 6	13.1	1 2
Charleston, S. C	1 9. 2	10. 5	1.2	11.1	9. 2	7.8	12, 6	10. 6	7.9	11. 5	11.7	6. 0	11.4	13.8	y D
Augusta, Ga	10. 5	9. 3	11. 2	8. 6	11, 2	8.5	11.9	10. 3	8.8	IL	11. 3	7. 5	12.2	13. 1	9.0
Savannah, Ga	8.8	11. 2	11.0	9. 5	10. 3	8. 5	11. 0	11. 2	8. 2	11. 0	13. 8	6.0	LL	13. 9	0
Jacksonville, Fla	8.0	12. 9	9, 5	9.9	10. 6	7.8	12. 5	12.1	5.6	12. 1	12, 1	0. 8	10. 6	14. 7	10
lorida Peninsula: Cedar Keys, Fla	0.7		7.0		0.5	400	10 0	10 0	00	12 1	10.0	0.0	10 0	12.9	
Key West, Fla			5. 2							14 5	19 1	9 6	0.9	17.1	10
Sanford, Fla	8.5	10 5	12 0	19 0	11 0	5 5	13.5	11 0	6.5	14 6	17.6	3 0	11.0	75.7	12
astern Gulf States:	0, 0	10. 0	12.0	12.0	11.0	0.0	10.0	11.0	0. 5	130.4	10.4	0.0		Tare .	ľ
Atlanta, Ga	6.0	11 1	13.0	9 1	9.1	10.0	11.4	10.7	8 0	10 0	12, 1	7.9	11.3	12.4	7
Pensacola Fla	6. 9	13.5	11.3	9.8	10. 7	7.8	12.2	11. (	7.8	10. 1	19.7	0.8			
Mobile, Ala	8. 2	11.7	11. 1	8.8	10. 8	8.7	11.2	10. 4	9, 4	9.8	11.6	8.6	11. 7	13.5	5
Montgomery, Ala	6.0	10. 8	14. 2	7. 5	10. 4	10, 3	11.6	9. 1	9.5	10. 2	10. 9	8.9	11.2	13.8	6
Montgomery, Ala Vicksburg, Miss	6. 9	10, 6	13, 5	7. 9	9.7	10, 6	10, 3	10.7	10, 0	10. €	11.1	7.5	12.1	12.1	6
New Orleans, La	7.7	12.4	10.9	8.7	10. 5	9. 1	9.9	10. 1	10.2	10. 3	10. 8	8.9	9.9	14, 5	6
	1	1000	1		15	1.00	100	1	100	0.7	1	150	-	1	1
Shreveport, La	7.7								0.8						
Fort Smith, Ark	11.7								9.0						
Little Rock, Ark	1 8. 3	10. 5	12. 2	8, 1	8.7	11.5	10,5	9.8	10.7	10, 8	12. 2	7.0	10.7	13.2	7
Galveston, Tex	8.3	9. 6	13. 1	7.7	10.4	10. 2	8, 1	12, 0	10.3 9.8 11.0	9. 0	10.0	9.8	9.3	14. 9	6
Indianola, Tex	8.5	12.3	10, 2	6. 8	11.1	10.4	7.0	14. 2	9.8	8.7	12.4	8.4	7.7	15, 8	ħΞ
Palestine, Tex	9. 3	13. 7	8.0	9, 0	8.7	10.7	7. 7	12. 3	11.0	7.0	15. 2	7,8	7.8	16.0	2
San Antonio, Tex	10.0	8. 2	12.8	9.8	6. 2	12. 2	10.€	9.6	11.4	8. (	11.1	10.3	6.0	15.0	10
lio Grande Valley:	1.			100	1		12			1		1.	100	1.0	1.
Brownsville, Tex	7.8	10.0	13. 2	7.6	8. 6	12.1	0, 8	10.7	13.5	6. 5	13.4	10. 1	8.0	15.0	1 3
Rio Grande City, Tex	9. 8	10.0	11.2	8.1	6.8	0.4	10. 1	11. 1	9.8	13. 1	10. 8	6. 0	10.0	10.9	0
hio Valley and Tennessee:					100	120	10 .	0	10.0	0 .	100		In .	100	
Chattanooga, Tenn Knoxville, Tenn	6. 2	19. 8	15. 0	7. 3	10. 0	11, 0	10.€	9. 6	10.8	9. 1	120	8.0	12.	1520	1.0

¹ Station closed October 31, 1885.

# APPENDIX 53.

States Army, for each month of the year. Computed from the commencement of observations from the tri-daily observations.

comprise from 0 to 8 tenths; fair, 9 to 22; and cloudy, 23 to 30, inclusive.]

J	nne.		-	July.		A	igust		Sep	temb	er.	Oc	tobe	r.	Nov	emb	er.	Dec	emb	er.
Clear.	Fair.	Cloudy.	Clear.	Fair.	Cloudy.	Clear.	Fair.	Cloudy.	Clear.	Fair.	Cloudy.	Clear.	Fair.	Cloudy.	Clear.	Fair.	Cloudy.	Clear.	Fair.	Cloudy.
5. 9 8. 4 6. 9 8. 8 13. 4 9. 5 10. 9	13.7 10.8 11.7 12.0 12.8	7.7	7.6 12.4 8.7	14.7 11.9	7. 2	11. 0 7. 9 10. 5 9. 6 10. 5	12.7 13.1 11.9 16.8 12.9	7.3 10.0 8.6 4.6 7.6	10. 8 8. 0 10. 6 12. 0	11. 1 10. 5 10. 3 12. 3 10. 6	8. 2 11. 5 9. 1 5. 7 8. 2	10.1 11.0 11.0	11.7 9.5 11.4 11.7 11.8	10.3 14.0 9.5 8.3 8.2	8.9 5.9 8.8 8.8 10.0	8, 8 10, 1	9. 9 15. 3 11. 1 8. 7 8. 7	8, 5 6, 5 7, 3 6, 8 8, 4	11. 9 13. 1 9. 7 11. 2 14. 7 12. 9 12. 8	9. 4 14. 1 12. 7 9. 1 10. 4
9.3 8.3 9.0 10.9 8.4 13.1 9.5 7.7 8.3 10.8 8.8 9.6 9.6	14. 9 13. 7 12. 7 15. 8 9. 5 13. 7 15. 2 12. 9 16. 2 12. 1	6.8 7.3 6.4 5.8 7.4 6.8 7.1 6.5 6.3	7. 9 9. 5 10. 5 9. 3 12. 2 8. 5 9. 0 9. 3 9. 7 9. 8 10. 5	15.5 12.0	7. 3 7. 4 6. 3 6. 2 6. 8 6. 7 7. 3 6. 6 5. 7 6. 4	11. 5 9. 8 10. 7 10. 9 9. 8 12. 0 10. 6 9. 8 9. 2 9. 1 10. 5 9. 9 9. 2	14. 0 8. 5 12. 6 12. 5 13. 5 14. 1 12. 8 12. 8	8.7 9.9 9.1 7.2 8.5 7.8 8.7 8.3 7.8	10. 1 11. 4 11. 6 10. 4 13. 2 10. 7 11. 3 11. 7 13. 5	11. 8 11. 7 10. 7 10. 7 12. 6 8. 6 11. 6 11. 5 10. 3 11. 3 11. 1	8, 2 7, 9 7, 7 7, 0 8, 2 7, 7 7, 5 8, 2 8, 0 5, 2 6, 6	10. 4 11. 4 12. 7 11. 1 14. 6 11. 2 11. 3 13. 3 11. 2 15. 2	12. 7 11. 7 10. 6 12. 2 8. 5 12. 3 12. 1 11. 6 10. 3 12. 8 9. 3	7.9 7.7 7.7 7.9 7.5 7.7 8.1 7.4 7.0 6.5	8, 8 9, 7 9, 9 10, 2 9, 4 9, 7 8, 6 10, 1 11, 3 11, 2	11. 4 10. 9 10. 6 10. 5 8. 4 11. 4 11. 0	9. 7 9. 6 11. 4 9. 2 9. 3 9. 6 10. 3 8. 2 7. 1	6. 0 6. 1 9. 3 8. 2 9. 3 6. 9 7. 8 8. 4 8. 8	11, 8 13, 5 13, 1 11, 8 12, 5 9, 5 14, 0 13, 7 13, 0 11, 8 13, 5 11, 7	11. 5 11. 8 9. 9 10. 3 12. 2 10. 1 9. 5 10. 2 10. 8 8. 7 8 1
8.1 8.4 10.9 6.2 10.4 9.2 8.7 8.1 7.4 8.0	15, 8 13, 3 13, 0 14, 5 15, 2 15, 6	4.6 6.0 8.0 6.3 7.8 6.8 6.7	9.8 10.8 9.2 9.3 9.6 10.1	16.3 15.6 15.7 13.0 15.2 14.7 15.2 14.9 16.2 16.5	5.8 5.5 7.2 6.6 17.0 6.2 6.0 5.7	9. 0 9. 2 8. 6 7. 8 8. 7 8. 4 8. 7 8. 2 7. 4 9. 2	14. 9 14. 8 13. 2 13. 5 14. 6 15. 7 15. 3	10.0 7.5 8.4 9.1 9.1 7.7 7.1	9. 8 11. 5 10. 6 11. 1 9. 5 10. 4 10. 3 8. 9	11. 6 13. 0 11. 3 10. 4 10. 2 11. 3 10. 8 12. 5 11. 7	17. 2 7. 2 7. 0 8. 7 9. 2 6. 4 7. 2 9. 4	10. 4 11. 9 11. 6 12. 8 13. 7 14. 1 14. 9	14. 0 11. 7 13. 4 10. 4 9. 9 10. 5 9. 8 11. 5	6.6 7.4 6.0 7.8 7.4 6.4 6.3	10, 4 11, 0 10, 3 11, 3 11, 6 10, 9 10, 5	14, 0 11, 6 12, 4 11, 6 9, 3 10, 6	7.0 8.0 6.6 8.1 9.3 7.8 8.8 8.2	7, 8 8, 6 8, 0 10, 3 11, 6 10, 3 10, 9	11. 9 13. 2 13. 4 15. 2 11. 7 11. 7 10. 9 11. 2 10. 7 12. 0	10.0 7.7 5.0 9.0 9.0 9.0
6.7 6.1 5.3	19.0 18.2 19.0	5.1	9, 8 5, 8 9, 3	15. 4 20. 1 19. 7	5.1	10.0 4.7 7.0	15. 0 20. 9 21. 3	5.4	3.7	13. 2 20. 1 16. 3	6. 2	7.9	16. 3	6, 8		14.3	5, 5	14.0 10.9 12.7	15, 4	4.5
7.7 10.8 9.3 7.4 10.0 8.0	14. 2 13. 9 14. 5 14. 8 15. 3 16. 5	5,3 6.2 7.6 4.7	10.2	15. 3 16. 2 15. 4 16. 4 15. 3 17. 5	5, 5 7, 1 6, 5 5, 5	8.0 9.2 8.9 8.5 11.1 8.0	15. 0 15. 7 15. 2 16. 0 15. 8 18. 5	6.1 6.9 6.5 4.1	12.0 12.2 11.1 12.2	11. 4 12. 3 10. 7 11. 5 10. 5 13. 1	5.7 7.1 7.4	14.6	10. 2 10. 1 9. 2 9. 8	7.0 7.0 8.4 6.6	11.1 11.7 11.4 10.2		8.3 8.2 8.8 8.9	9, 8 10, 1 8, 9 8, 9	12. 3 11. 9 11. 6 10. 2 10. 2 11. 5	9. 8 9. 1 11. 1
9. 1 11. 2 12. 8 12. 2 10. 0 10. 0 6. 7	16, 4 13, 3 14, 2 13, 5 16, 9 17, 2 19, 1	5.5 3.0 4.3 3.1 2.8	13.4 11.7		5. 0 5. 1 3. 3 1. 9 2. 3		11, 7 13, 7 15, 7 16, 0	5.5 3.6 4.6 2.8 2.0	14. 5 14. 1 12. 5 12. 1	9. 6 10. 0 10. 0 11. 7 13. 0 12. 0 12. 6	5.5 5.9 5.8 4.9 5.0	11. 2 13. 6 14. 3 14. 7 12. 2	12, 3 11, 3 10, 9 11, 7 13, 3	7.5 6.1 5.8 4.6 5.5	11. 2 12. 8 11. 0 10. 3 12. 0		7.0 8.6 8.1 7.6 7.5	9.7 11.0 9.1 9.1	9. 5 11. 8 9. 7 10. 0 11. 0 13. 2 9. 3	9. 1 10. 2 11. 3 10. 1 8. 8
14, 0 15, 0	12.8 11.1		14.1 16.0	13, 9 10, 3		11, 0 13, 2			11. 5 14. 3	12. 2 12. 1	5.8	12. 2 12. 9				11.9			12. 7 10. 8	
10.4 8.2	15, 0 14, 9	4, 6 6, 9	10.3	16, 3 14, 8	4.4	8.0 10.3	16, 9 14, 5	6.3	11.1	13, 4 10, 0	5,5	11.9 15.0	11.0	8.1	10. 9		9.4 10.6		10, 1	

### Average number of clear, fair, and cloudy days at stations of the Signal

	J	muan	ry.	Fe	brua	ry.	3	Larel	1.	1	Apri	L		May.	
Districts and stations.	Clear.	Fair.	Cloudy.	Clear.	Fate.	Cloudy,	Clear.	Fair.	Cloudy.	Clear.	Fair.	Cloudy.	Clear.	Fair.	Cloudy.
hio Valley and Tennessee-Cont's	1.	-	1				7								T
Memphis, Tenn	7.5							10.5	10.8	10.1	10.7	2.2	9.5	12.0	7.
Nashville, Tenn	5.5		14.6											(14-3	
Louisville, Ky	6.2													12.0	
Greencastle, Ind	8.0	111.0	14.4	8, 0	0.7	7. 0	6.1	11 2	12 6	6.5	111.0	20. 9	0 3	19.0	10
Indianapolis, Ind Cincinnati, Ohio			15.5				6.3	12.3	19.4	8.0	11.0	10. 1	9.4	13,7	12
Columbus, Obio	4.6	10. 8	15. 6	4.7	10.7	12.9	5.1	11. 6	14.3	9.3	9, 6	11.1	10.1	12.8	ďΫ
Pittsburg, Pa	4.1	11.7	15, 2	4.7	11.8	11.8	4.4	13. 6	13.0	7.1	12. 9	10.0	10.	1 13. 2	12
ower Lakes:	1	100			1		1				E.C		12.	ALC:	10
Buffalo, N. Y. Oswego, N. Y. Rochester, N. Y.	a 1.3	9.4	20. 3	4.5	10.0	13. 2	4.1	12.7	13. 4	6. :	11.7	11.1	9.8.3	122.1	9.9
Oswego, N. Y.	. 1.1	7.1	22. 8	3.1	8. 5	16.6	8.1	11.1	16, 0	0.7	10.0	112.7	100	1 12.2	3 3
Erle, Pa	0.1	10 1	19 8	4.3	10.6	19. 1	4	112.5	14 1	B. 0	113.5	12. 2	10.5	7 700 /	1 3
Cleveland, Ohio	3.1	9.1	18.8	4.7	11.0	11 8	4.	12.5	14.1	7.1	2 73, 1	0.5	10.4	12.6	l á
Sandusky, Ohio	5.4	10.9	14.7	5. 6											
Toledo Obio	3.8	11.5	14.7	4.7	11. 5	-12.0	1 D. 3	510.4	14. 8	6.2	212.5	(10, 5	E 10.	2012.0	и о
Detroit, Mich	4.4	10.3	16.7	5. 5	11.1	11.3	5.	5 12. (	12.9	7.1	12.1	10.1	22,	113.7	417
pper Lakes:	100				100			10.1		n 1	100			dea .	J.
Paganaha Mich	5	110.3	119.6	5 7	10. 2	10.1	7.1	110.	10. 7	B 1	012	0.3	2	8 1 1 J	16
Grand Haven Mich	1.1	8 8 1	21.1	40.0	5-10.4	113 4	4.1	013.3	12.9	8.4	112.0	0.1	11.	5 12. (	
Mackinaw City, Mich	20	13. 2	11.7	6.1	10.0	12.3	9.	13.	B. 0	9. (	11.4	0.7	. 8.	3.12.7	11
Marquette, Mich	4.0	12.1	14.5	5.1	111.1	12. 2	8.1	12.4	10.6	8.1	12.0	P. 8.1	5 9.1	812.1	5
pper takes: Alpena, Mich Escanaba, Mich Grand Haven, Mich Mackinaw City, Mich Marquette, Mich Port Huron, Mich Chicago, III Milwaukee, Wit Doluth Mico	3.5	12.4	14.9	5. 1	111.5	12. 0	5.	14.0	11.9	7.1	112.	10.1	2 9.5	2 12, (	R. t
Chicago, III	7.	5 13. (	10.5	8.	111.3	9. 0	6.1	13.	11.1	7.1	3 11.	9.3	1 10.	9.11.1	7. 1
Milwaukee, Wist	0.1	14.	10.5	6.0	12.	10.6	6.	0 13. 3	11.0	6.	13,	10.0	8.1	9 13,4	93
Duluth, Minn	110	211.	8, 1	8. 1	10.	9.0	10.	11.	0. 1	100		30. 2	. 0.	12.	100
Saint Paul, Minn	183	12.5	0.0	8 1	10.5	0.0	8	2 12 (	10.2	7.1	911.1	10.5	2 2 5	9 14.3	8
La Crosse, Wis	9.	3 12 8	8 8.9	8.0	12.	8.2	8.4	5 12.	0.7	9.3	2.11.3	7 9.1	1 9,	912	ďί
Davenport, Iowa	. 8.1	9 11.4	10, 8	7.1	10.1	9.8	7.	6 13. 1	10. 5	7.4	4 12. 5	5 10. 1	I B.	9(12.4	9 3
Des Moines, Iowa	. 10.1	9 11. 3	8, 8	8,1	9 10. 7	8.7	8.	0 13.	9. 6	7.1	5 11. (	0.11.4	1 7.	4 12.	F1.
Dubuque, Iowa	7.	2 12.5	3 11, 5	7.	10.1	10.0	6,	0 13.5	11.7	6.	12.	211.	7.	612.	11
Keokuk, Iowa		11.5	12.8	16.	111.0	10.5	4.	7 14.1	111.4	4.	9 14.	2 10.3	4.	9 16,	5) 3
Caire, III Springfield, III	6.													7 14, 6	
Saint Louis	10		10.0	4	10.3	0 1	R	2 11	11.1	8	0 11	9.4	9.	819	
dissouri Valley;		4.65	1000	100	1000		100		1		100	100	100	4	4
Longwood by Tong	9.1	6 11.	0 9. 8	8.1	8 11.	8.4	8.	8 13.	8, 8	8.1	5 10.	7 10.1	8 7.	613.	6 3
Omaha, Nebr	. 9.	9 12, 5	8,1	9.	10.	8.2	9.	1 12.	9, 1	8,	4 10, 5	5 11.	1 7.	3 11.	4 2
Bennett, Fort, Dak,	- Ru	6 16, 2	5.0	9.	0 12. (	7. 2	7.	2 15.	R. 4	7.	4 12, 0	0 10.4	6 B.	0 13.	0 1
Omaha, Nebr. Bennett, Fort, Dak, Huron, Dak Yankton, Dak	10.	0116.	8 4.3	10.	2 10.0	0 8.0	5.	2016.	9.3	8.	111.1	8 9.4	110.	0 12.1	93
Extreme Northwest:	- 10.	114.	0.4	9.	ILI.	4.25	0.	113.	0. 1	3.	12.	9.	8.	412	6/21
Moorbead, Minn. Saint Vincent, Minn. Saint Vincent, Minn. Butard, Fast Buford, Fort, Dak. Totten, Fort, Dak	11	0 15	0 4	B	111	2 9	6	115	8 8 8	8	6 12	9 8	9 8	8 13	ol i
Saint Vincent, Minn	12	114.	4.3	0.	1 12.	6 6	9.	2 15	6. (	10.	6 10.	4 7.1	0 10.	8 14.	RI I
Biomarck, Dak	- 10.	3 14.	2 6.1	8.	511.	5 8.5	6.	6 13.	10.8	7.	9 12.	4 9.	7 6.	8 14,	0 1
Buford, Fort, Dak	7.	5 15.	7 7.1	9,	6 11.	9 6. 5	7.	4 14.	8,1	9.	4 12.	4 8.	2 8.	7 14.	5 3
Totten, Fort, Dak	15.	0 14.	0 2.0	16.	0 7.	5. (	5.	0 16.	10. (	(3)	(3)	(3)	11.	0 12,	0
Northern Slope; Assinabeine, Fort, Mont. Bentan, Fort, Mont. Custer, Fort, Mont. Helema, Mont. Maginnis, Fort, Mont. Poplar River, Mont. Shaw, Fort, Mont. Dendwood, Dak. Cheyenne, Wyo. North Platte, Nebr. Middle Slope;			0 0				10	o in				0 0	1-	diam	1
Bentun Fort Mont	· V.	5 14.	0 9.4	8.	0 12.	9 10 1	2 10.	011	0 7.1	9.	8 14.	0 0	0 8	3 17.	3
Custer, Fort, Mont	1 9	6 15	2 8 5	4	0 16	6 7 3	R R	015	6 7	5.	8 16.	6 7	6 6	0 17.	al :
Helena, Mont.	3.	6 14.	8 12.0	4	6 14.	4 0.3	11.	0 13.	8 6.	8.	0 14.	2 7.	8 6.	7 17.	al :
Maginnia, Fort, Mont	. 4.	6 11.	7 14.	6.	0.13.	3 9, 6	0 10,	0 9.	7 11.	8.	3 12.	7 9.	0 8.	0 16.	0
Poplar River, Mont	13.	0 11.	5 6.	11.	7 8.	3 8.	3 8.	5 14.	0 8.	14.	0 9.	0 7.	0 17.	0 11.	2
Shaw, Fort, Mont	6.	2 15.	8 9.0	7.	6 13.	8 6.1	8 13.	2 11.	6,	10.	0.12.	7 7.	3 9.	2 16.	
Cleanwood, Dak	11.	2 13.	6 6.3	8.	1 14.	2 5,1	9 9.	0 13.	9 7.	8.	412.	2 2.	9 7.	20 14.	510
North Platte Nahr	1.3.	9 13.	7 5	12.	5.19	5 6	9 12,	9 14	3 3.	8.	4 15	5 8	1 6	915	1
Middle Slope:		Las	1 55.	10.	1 4.41	9,1	3	2 34.	1	10.	7.00	1	-	-	1
Denver, Colo	. 15.	9 11.	4 3	7 12	111	0 3	4 13.	3 11.	0 0	0.	7 12	0 7.	4 8	714	gl:
Piko's Peak, Colo	14.	4 11.	7 4.1	9 10.	0.13.	0 5.	2 11.	3 12.	4 7.	1 7.	5 14.	7 7.	8 7.	3 16.	M.
Denver, Colo	.: 13,	7 14.	0 3,	3.14.	5 10.	2 3.	5 13.	0 14	2 2,	8 8.	8 15.	2 6.	0 6,	2 17.	3
Dodge City, Kans Elliott, Fort, Tex	12.	7 10.	5 7.	8.12.	5 0.	5 6,	2 12.	4112.	1 6.	512.	1 12.	2 5.	7 6.	4 15,	4
Fillott, Fort, Tex	17.	5 7.	2 6.	3 15.	2 7	2 5,	8 13.	6 12.	M 4.1	5 15.	8 9.	2 5.	0 10.	9/13	3
Southern Slope; Sell Fort Lod T	10	210	9 0	0.70	n n	0 0	110	0.10	0 0	119	171	7 6	9 10	4.75	7
Conche Fort Toy 1	3 10	1 16	4 0	5 10	0 7	7 7	612	6 0	11 7	8 14	2 17	1 4	6 0	0 13	1
Davis, Fort, Tex	17	1 0	7 4	2.15	9 0	4 3	8 14	0.10	3 4	7 10	0 8	4 2	6.15	8 12	D
Sul, Fort, Ind. T Concho, Fort, Tex. Davis, Fort, Tex Stockton, Fort, Tex	. 18.	9 6.	7 0.	1 16	0 6	4 3	9 18	N B	6 3.	6 17.	8 9.	2 3	0 16	210.	8
Southern Plateau:	1		1	1	7	1	1		1	1	1	1		1	
Santa Fé, N. Mex El l'aso, Tex Apache, Fort, Ariz. Grant, Fort, Ariz.	15,	411.	2 4.	4 11.	5 12.	5 4.	3 12.	5113.	8 4.	7 11.	2 13,	0 3.	8 11.	8,15,	71
El Paso, Tex	16.	6 11.	4 3,	0 17.	0 8.	2 3.	0 19.	7 9,	1 3.	2 10.	7 8.	H 1.	5 2L.	8 7.	6
				0.14	NT U	441 77 1	711/6	ALC: OLD	(3) 15. 1	6116	20 1 (1)	251 55	DESCRIPTION.	10.00	7

¹ Station closed November 30, 1885. 
² Record incomplete. 
² Station closed September 15, 1885.

### REPORT OF THE CHIEF SIGNAL OFFICER.

### Service, United States Army, for each month of the year, &o. - Continued.

2	une.		- 3	July.		Λ	ngus	t.	Sep	teml	er.	Oc	tobe	r.	Nov	em1	er.	De	ceml	er.
Clear.	Fair.	Cloudy.	Clear.	Fair.	Cloudy.	Clear.	Fair.	Cloudy.	Clear.	Fair.	Cloudy.	Clear.	Fair.	Cloudy.	Clear.	Fair.	Cloudy.	Clear.	Fair.	Cloudy.
8.7 6.3 6.8 9.0 6.8 7.1 8.3 7.4	15, 9 17, 6 13, 9 15, 0 13, 7 13, 3 13, 9 16, 4	6.7 9.3 6.0 9.5	9. 2 9. 5	14. 5 16. 5 14. 9 16. 0 14. 4 13. 5 16. 2 16. 7	7.4	11.0 11.3 11.5 12.4	16.0 14.0	6. 9 5. 5 4. 0 5. 7 7. 1 6. 5	11. 5 15. 0 11. 7 11. 1 10. 8	11. 9 11. 7 5. 0 11. 3 10. 9 12. 7	7. 0 6. 6 6. 8 10. 0 7. 0 8. 0 6. 5 7. 3	12.5 12.1 11.5 9.9 11.1 9.5	11. 2 12. 1 15. 0 12. 4 11. 5 12. 5	7.3 6.8 4.5 8.7 8.4	7.7 10.0 6.5 7.1 6.4	10. 0 8. 5 9. 9 11. 1 12. 1	10. 9 10. 7 12. 3 11. 5 13. 6 11. 8 11. 5 13. 4	5. 7 6. 1 5. 5 5. 3 5. 7 3. 2	10. 4 11. 4 9. 0 9. 0 9. 8 11. 0 10. 8 12. 4	13. 9 15. 0 16. 9 15. 9 14. 3
8.4 8.6 8.2 9.9 9.6 9.6 7.7 9.0	13.6 12.8 12.4 13.2 13.7 13.7 14.2 13.2	8.6 9.4 6.9 6.7 6.7 8.1	9, 1 8, 6 10, 4 10, 1 10, 6 9, 3	15. 7 14: 9 15. 0 15. 3 15. 6 15. 0 15. 6 15. 6	7.4 5.3 5.3 5.4 6.1	10.1 11.3 12.3 11.2 11.7	13. 8 12. 8	7.5 5.9 5.6 6.0 6.5	7. 5 8. 4 9. 3 9. 7 10. 8 11. 9	12. 6 12. 0 13. 0 12. 2 11. 6 12. 9 11. 8 13. 1	10.5 8.6 8.5 8.7 6.3 7.3	5.3 6.5 7.5 8.3 8.9 8.5	10.3 11.1 9.2 10.6 11.4 11.9	12. 6 15. 4 13. 4 14. 3 12. 1 10. 7 10. 6 10. 5	1.3 2.4 1.9 3.3 4.2 4.7	9. 0 8. 6 9. 1 11. 8	18. 5 22. 3 18. 6 19. 5 17. 6 14. 0 14. 2 14. 9	0,7 0,9 1,4 2,0 2,6 3,0	8.9 5.5 6.7 6.8 10.0 9.7 11.0	24. 8 23. 4 22. 1 19. 6 18. 7 17. 6
7. 9 9. 7 10. 7 9. 8 9. 1	14. 0 12. 3 12. 8 13. 5 14. 4 16. 2	7, 2 6, 3 7, 0 7, 4 7, 4 8, 0 7, 9	9.7 13.6 8.3 9.8 9.7 12.1 9.5	15, 2 13, 4 16, 4 15, 1	6. 1 4. 0 6. 3 6. 1 5. 6 5. 0 4. 7	9. 7 13. 3 11. 0 10. 6 9. 8 12. 4 9. 9	13, 8	7.7 4.4 7.7 7.0 6.4 4.8 5.7	7, 5 10, 5 9, 0 7, 3 8, 8 11, 3 8, 8	12. 2 14. 2 12. 8 14. 8 12. 4 14. 4 12. 2 14. 1	8.3 6.7 6.2 10.3 6.8 6.5	5.3 8.2 4.7 5.1 6.0 9.3 7.0	11.3 10.3 13.5 11.3 13.1 12.5 13.1	13.7 14.4 12.5 12.8 14.6 11.9 9.2 10.9 14.2	3. 5 2. 9 1. 2 2. 1 3. 7 6. 6 4. 8	11. 1 9. 4 8. 8 9. 5 11. 2 10. 5	316. 8 115. 4 117. 7 20. 0 18. 4 15. 1 12. 9 13. 2 13. 4	3.4 1.3 0.2 2.5 2.0 6.0 4.8	8. 9 11. 7 7. 6 6. 5 10. 1 11. 8 12. 9	15. 22. 24. 18. 18. 12.
8.8 7.1 5.1 5.8 3.7	14.8 15.2 13.5 15.9 15.0	7. 2 8. 1 9. 7 10. 7 10. 4 6. 1 8. 5	10. 5 10. 2 9. 1 9. 1 7. 5 11. 5 12. 7	14. 4 15. 4 15. 0 15. 0 16. 3 13. 3 14. 3	6.1 5.4 6.9 6.9 7.2 6.2 4.0	10.9 11.8 11.4	14. 7 13. 9 13. 4 12. 5 14. 1 15. 7 12. 6 15. 6 13. 7	6. 2 5. 8 7. 1 6. 9 6. 1 3. 5 3. 1	11, 1 10, 9 10, 8 8, 8 10, 0 13, 6 14, 0	11.7 13.1 12.5 11.2	7.1 6.5 7.5 8.1 7.5	9, 4 10, 0 10, 5 7, 5 9, 1 13, 7 11, 3	11. 8 11. 1 12. 2 12. 2	8, 5 9, 8 9, 9 8, 3 11, 3 9, 5 6, 6 7, 4 6, 2	6. 1 7. 3 10. 8 5. 5 6. 1 9. 1	11. 1 11. 2 11. 9 11. 5 10. 2 12. 3	10. 1 12. 8 11. 6 8. 0 12. 6 12. 4 2 10. 7 2 8. 4 9. 9	8. 1 6. 0 6. 1 5. 0 7. 1	12. 7 12. 7 12. 7 13. 8 11. 7 10. 12. 2 2 11.	1 10. 5 12. 5 11. 8 13. 7 13. 8 12.
8. 7 8. 1 10. 0 10. 5 9. 6	15. 5 13. 6 13. 4 15. 8	8, 3 6, 6 3, 7	10.5 9.0 10.0	14.4 17.5 16.2	5.3 6.1 4.5 4.8 5.3	13, 6 11, 9 11, 4 12, 6 12, 8	12.6 12.9 14.4 13.8 12.7	4.8 6.2 5.2 4.6 5.5	13. ( 13. 1 12. 3 12. ( 12. (	10. 9 10. 2 13. 3 13. 2 12. 1	6. 1 6. 0 4. 4 4. 8 5. 5	12.3 13.0 11.0 9.2 11.8	12. 2 10. 7 12. 8 12. 0	6.5 7.3 7.2 9.2 7.4	10 5	11, 8	8 7.5 8 8.2 6 6.2	8, 9 9, 6 8, 1	11. 12. 15. 14. 14.	9 10. 7 9. 7 7. 0 6.
5.2 9.2 6.6 7.7 9.0	16.3	5. 2 7. 1 7. 6	7.8 9.2 10.4 0.8 7.5	16. 4	5.4	11.0	16. 2 15. 4 13. 6 12. 8 15. 5	4.4 4.6 4.2	9. 8 10. 8 12.	14. 6 13. 5 112. 4	5.6 5.9 5.2 4.6	8, 2 7, 3 10, 2	13. 0 10. 7 12. 1	9.8 13.0 8.7 9.4	5. 5. 5. 7. 6	15. 6 14. 6 12. 6 7 16. 6	9.6 7 9.8 9.6 2 8.1 5 10.5	9.1	2 16, 8 15, 2 14, 4 16, 0 13,	7 5. 8 R. 0 7.
12.7 8.8 8.0 8.3 8.7 13.0 8.7 8.6 11.4	14.8 16.2 15.7 13.3 13.7 16.0 16.7	6.0 8.0 3.3 5.3 5.2	14. 0 10. 6 13. 8 10. 3 15. 3 15. 0 15. 2 13. 1	16.6 14.2 15.4 12.3 12.7 13.2	3.7 3.8 3.0 5.3 3.4 3.3 2.6 4.8	16, 7 14, 8 18, 2 15, 2 18, 6 17, 6 15, 9 12, 5	10.8 13.6 10.7 11.0 9.8 11.0 11.7	3.5 2.6 2.1 4.8 3.2 3.4 4.3	14, 11, 14, 13, 18, 16,	2 14. 2 7 11. 9 2 12. 1 8 10. 0 13. 0 11. 5 7 8. 3	5.6 4.4 3.7 8.0 5.0 5.0 7.0 8.0 8.0 8.0 8.0 8.0 8.0 8.0 8.0 8.0 8	10.5 10.8 9.8 12.5	2 12, 2 2 12, 4 3 15, 3 3 13, 1 4 13, 0 7 13, 3 5 10, 4	10.3 1 8.4 2 5.0 2 8.0 5.7 2 7.1 4.6	7. 7. 8. 8. 11. 9. 14.	5 13. 6 17. 7 15. 9 13. 2 12. 8 14. 8 9. 4 12.	8 8.2 5 6.3 6 6.2 6 5.6	5. 6. 7. 7. 9. 8. 11. 13.	1 13.	7 11. 1 11. 8 7. 8 10. 7 7. 5 7. 8 6.
12.5 11.3	13. 4 15. 9 13. 2 13. 8 11. 5	4.3	11, 2	14. 2	5.0	11.6	11.4 17.6 14.6 12.2	4.8 6.7 5.2 4.4	16. 13. 16. 15.	8 9.4 9 12.8 5 10.6	3.8	15. 9 15. 9 16. 6 16. 9	0 10. 1 0 10. 1 0 10. 1	4.6	15. 14. 16. 13.	911.	8 2.2 9 5.2	10.	6 11.	9 6,
13.7	13.3 11.7 11.9 11.0	2 0	12.5	12.2	4.9	10.2	12 1	0 0	11	2.11.2	4.0	14 7	11	50	19	0 11	0 0 8	11	0.10	0 0
	14. 4 10. 1 6. 1 9. 0	1		1	100	1000					1 -			1 -	1	4	11			100

### Average number of clear, fair, and cloudy days at stations of the Signal

	J,	anua	ry.	Fe	bra	ary.	3	Larc	h.	.	Apri	L.		May	7.
Districts and stations.	Clear.	Fair.	Cloudy.	Clear.	Fair.	Cloudy.	Clear.	Fair.	Cloudy.	Clear.	Fair.	Cloudy.	Clear.	Fair.	Cloudy.
Southern Plateau—Continued:	1	1						l			] 	1	1		
Prescott, Ariz	18. 1	10.	2.4	17.5	7.4	8.4	17. 8	9. 4	4.3	19.0	8.9	2.1	23.7	6.4	0.
Thomas, Fort, Ariz	15.8	12.5	2. 7	14.0	10. 4	3.8	14.6	11.8	4.6	19. 5	8.8	2.2	23. 5	4 0.7	0.
Yuma, Ariz	20. 2	8.4	2.4	18.6	7.8	2.4	20. 6	8.2	2.2	22.8	6.4	0.8	26.7	3.7	0.
Middle Plateau:	١		۔ ۔ ا	۔ ۔ ا			٠	۔ ۔ ا	!	١	ا ۔۔ ۔	۱	ا ۔۔	٠ ١	۱.
Winnemucca, Nev	11.6	12.	1 7. 3	9. 7	10. 0	7. 6	14. 7	10. 1	6. 2	11.4	12.0	6.0	13.8	12.6	5.
Salt Lake City, Utah	8.2	111.7	111. 1	7.2	10. 7	10.4	10. 6	H10. 7	9.7	7.5	12.8	9.7	10.7	13. 2	7.
Northern Plateau:	١.,	١.,		١.,			10.5		ء م	، ، ا			ء ۾ ا		ماد
Boisé City, Idaho	1 10					11.0									
Lewiston, Idaho 1	1 3.	9. 0	110.	0.0	10.7	111.6	12.0	111. 0	7. 1	111. 0	111. 2	1.0	111. 0	13.	1 5
Spokane Falls, Wash	3.0	11.	110.	0. 5	10.	11. 8 12. 6	11.0	12.	1 2.0	11. 2	11.0	7.0	10. 0	14.6	7 4.
North Pacific Coast :	5. 0	112.	120.	0.0	9 0.0	12.0	14. 4	11.0	۱.۰	11.2	11. 0	1	9. 2	140.1	
Canby, Fort, Wash	۱.,		، مداد		10 5	9. 0	Q 8	14 8		9.5	14 6	7.0	. 4 6	114 6	12
Olympia, Wash	9.1	0	110.	0.1	7 9	17. 5	B 9	10.0	14 0	5 6	11.0	12	1 7 7	117.	119
Tatoosh Island, Wash	6.1	7.7	110.	0.0	1 : 6	15. 5	8 6	111 6	12.5	0.0	10 6	11 0	R	111.0	111
Portland, Oreg		7	110.	2. 7	1 6 6	19. 8	5.9	7 6	18 1	6 3	0.0	114 3	15.	10.	115
Roseburg, Oreg						16. 2	7 7	1111	19 6	5.4	11 6	118 6	000	10.0	11
Middle Pacific Coast:			7***	7 0	7 5 7		1 '''	1	1	0, 3	1	1.0.	]	1	1
Cape Mendocino, Cal	7.0	111.1	5/12.1	5 10. 5	10. F	7.5	11.8	11.1	8.1	7.0	14.7	8.3	8 7	118.5	1 4
Red Bluff Cal	13.0	8.	8	5 11. 5	9.0	7.5	14. 8	10.0	6.2	12 4	10.6	6.7	16 6	1 10 1	4
Red Bluff, Cal	12.1	10.	BR	13.6	8.5	7.0	15. 8	8 6	7. 2	14. 5	10.	5.4	20. 7	7	1 2
San Francisco, Cal	111.4	10.	3 9.	3 9.6	3 10. 4	1 8.2	11.3	11.4	8.8	111.7	111.1	6.5	14. 7	3 10. 1	5
South Pacific Coast:	1	1	1	1 ** '	1	1	1	1-20	1	1	1	1	1	,	1 -
Los Angeles, Cal	17.	5 8.0	8 4.1	0 13. 1	9. !	5 5. 6	12. 2	2 11. 0	7. 8	10. 4	12.5	7. 1	11.5	5 13. 5	s a
San Diego, Cal	12.2	211.	2 7.	B 9. 6	3 11. 1	7. 5	8.	5 13. 2	9. 2	9 9	12.6	7. 5	7.5	2 13. (	10
Alaska Stations	1	1	1	1	1	1	!	-	1	1	1	1	1	1	
Alexander, Fort	. 2.1	5 10.	5 18. (	0 14. 4	9. 0	ol 4. :	6. 5	5 9.0	15. 5	4.0	8.4	118.0	5. (	0'12. (	D 14
Alexander, Fort	6. 8	3 D.	7 14.	5 12.	7 7.	1 8. 5	8.7	10. 2	12. 1	5. 2	8.8	15. 1	4. (	9. 8	P 17.
Sitka	4.5	2 9. (	0 17.	B  6.4	1 9.2	2 12. 8	7. (	SI 7. 6	3 25. 8	8 CL 3	9. 5	14. 2	2 5, 5	5 0.	7115
Unalashka	. 1. 8	8 6. (	0 23. '	7  0.1	3 4.7	7 22. 8	3 2. 8	8 6.7	7,22. (	1. (	5.5	23.	5 1.0	D 9. :	2 30.
Behring's Island, Behring Sea.	. 0.0		7 26.												

¹Station closed December 31, 1885.

²Station closed Novembor 30, 1885.

Service, United States Army, for each month of the year, &c.—Continued.

	June.			July.		A	ugus	<b>L</b> .	Sep	temb	er.	Q ₀	tobe	r.	No	rem	er.	Dec	omb	er.
Clear.	Fair.	Cloudy.	Clear.	Fair.	Cloudy.	Clear.	Fair.	Cloudy.	Clear.	Fair.	Cloudy.	Clear.	Fair.	Cloudy.	Clear.	Fair.	Cloudy.	Clear.	Fair.	Cloudy.
23. 8 20. 2 26. 5	8.2	1.6	12.5	14.7	3.8	14. 6 10. 7 21. 0		2. 4 3. 6 1. 8	20.5	7.5	2. 0		6.6	2.0		7.8	2.0	17. 2	9.3	4.5
15. 5 14. 7	12.0 12.2					25. 7 15. 9		0.7 8.1		5. 3 9. 7	2. 1 2. 8	19. 3 13. 0	9.1 11.8	2. 6 6. 2	14. 0 10. 5	11.0 11.0	5.0 8.5	13. 0 8. 3		7. 1 12. 7
10. 5	13.0 14.0	6.5 6.5	17. 8	10.8 10.4	2.7 2.8	22. 7 22. 5	7.0 7.7	1.8 0.8	17. 0 16. 5 14. 4 13. 8	9.7 11.8	3. 8 3. 8	10.7	10. 8 11. 8	9.8	7. 8 9. 4	10. 8 10. 8	9. 0 11. 4 9. 8 12. 2	6. 2 5. 8	9. 6 9. 8	14. 0 15. 2 16. 4 14. 2
1. 0 5. 8 1. 5 6. 8 10. 0	11.6 13.0 9.7	12. 6 15. 5 13. 5	10. 8 7. 0	18.3 14.5 8.1	6. 9 9. 5 8. 4		12.8 13.0 8.9	6.0 6.7	6.4 4.0 11.9	11. 4 12. 5 11. 5 10. 1 9. 1	11. 1 14. 5 8. 0	4.9 8.0 7.8	11.7 11.8 9.8	8.6 14.4 11.7 13.4 9.6	2.1 2.0 5.1	9.7 7.7 9.0	17. 7 18. 2 20. 3 15. 9 12. 9	2. 2 4. 0 4. 3	8.0 8.7 7.8	14.3 20.8 18.3 18.9 17.9
10. 3 23. 0 24. 8 12. 0	5.0 4.1	2.0	29.3	3. 1 1. 6	0. 1 0. 1	28. 7 29. 6	2. 2 1. 4	0. 1 0. 0	19. 2 25. 4 26. 0 13. 0	3. 8 3. 6	0. 8 0. 4	21. 4 23. 0	7.1 5.9	2.5 2.1	18. 2 18. 0	6. 0 6. 9	5.1	12. 8 13. 0	9. 4 7. 9	10. 3 8. 8 10. 1 8. 7
9. 2 6. 6	15.8 15.8	5. 0 8. 1	12.3 8.3	17. 9 16. 6		16. 5 9. 9	13. 4 16. 9	1. 1 4. 2	17. 6 12. 1	11. 2 18. 9	1. 2 4. 0	17. 9 13. 6	10. 6 12. 3	2. 5 5. 1	18. 4 13. 6	8. 9 10. 5	2.7 5.9	17. 5 13. 1		
4. 5 3. 8 8. 0 0. 6 1. 3	10.8 6.0 6.0	18. 0 16. 4 16. 0 23. 4 23. 0	3. 1 3. 2 0. 8	7.2 8.8 7.4	21. 0 20. 7 19. 0 22. 8 20. 0	2.0 7.8 2.4	6.5 9.5 8.6	16. 0 22. 5 14. 2 20. 0 22. 7	2.0 7.8 0.7	8.5 7.9 7.5 5.0 11.3	20. 1 15. 2 24. 3	2.6 6.0 1.3	9. 2 8. 3 6. 7	15. 5 19. 2 16. 7 23. 0 18. 3	6. 8 3. 3 1. 0	9. 1 7. 8 6. 7	15. 0 14. 2 19. 4 22. 3 21. 4	9.7 6.7 1.0	9.6 9.1 8.0	14. 5 11. 6 15. 2 22. 0 20. 0

^{*}Station closed September 15, 1885. 

*Station closed December 31, 1885.

Record incomplete.

APPENDIX 54. •

Dates of closing of navigation on the lakes and rivers at selected stations of the Sig-

			MAV	GATION CL	OSED.	
Stations.	Lakes or rivers.	1871.	1872.	1872.	1874.	1875.
Albany, N. Y	Hudson River	Nov. 29	Dos. 10	Nov. 26	Dec. 15	Dec. 1
Alpena, Mich	Lake Huron	Dec. 10	Dec. 11	Dec. 5	Dec. 8	Dec. 14
Baltimore, Md	Patapaco River	(*)	(2)	(7)	(e)	
Benton, Fort, Mont	Missouri River	l. <b></b>	l <b>.</b>			
Bismarck, Dak	do	(3)	Dec. 11	Dec. 5	Nov. 17	Nov. 19
Buffalo N.Y	Lake Eric	Doc. 27	Dec. 18	Nov. 28	Dec. 5	Dec. 11
Suford, Fort, Dak	Missouri River					
Cairo, Ill	Mississippi River.	(3)	(2)	(3)	Dec. 1	Jan. 8
Iniro, Ill	Obio River	(3)	(4)	(2)	(t)	Feb. 1
chattanooga, Tenn	Tennessee River	(2)	(2)	n (f)	_ (P) _	O O
Chicago, Ill	Lake Michigan	D (3)	T (2)	Dec. 13	Dec. 1	(2)
Cincinnati. Ohio	Objo River	Dec. 21	Dec. 22		Jan. 11, 75	
Cieveland, Unio	Lose Brie	Dec. 11	Dec. 14	Dec. 12	Dec. 15	Dec. 10
Custer, Fort, Mont	Big Horn River Mississent River.	Thus.	Nov. 29	Dag #0	Nov. 30	37 am 04
Davenport, Iowa Detroit, Mich	Detroit River			Dec. 28	Dec. 17	Nov. 2
Dubuque. Iowa	Mississippi River	Nov. 11	(3) Nov. 18	Nov. 19	Nov. 21	(*) Nov. 1
Dalath, Minn	Lake Superior	Dec. 6	Nov. 24	Nov. 25	Dec. 9	Dec.
Grie, Pa	Lako Erio.	Dec. U	1101. 24	Dec. 15	Dec. 15	Dec. 1
Sscanaba, Mich	Little Bay de No-	Dec. 6	Nov. 30	Nov. 24	Nov. 28	Dec. 1
socialis, mich	quotte.	212.	1000.	2.0 2.	2101. 20	200. 1
Keokuk, Iowa	Mississippi River.	Dec. 4	Des. 4	(4)	Jan. 5	Nov. 2
La Crosse, Wis	do	Nov. 22	Nov. 22	Nov. 27	Nov. 29	Nov. 2
Leavenworth, Kans	Missouri River	(3)	(3)	(3)	Jan 5, 75	Feb. 4.
Louisville, Ky	Ohio River	(3)	(5)	(4)	( ² )	Jan. 1
Mackinaw City, Mich	Mackinaw Straits.					
Marquette, Mich	Lake Superior	Nov. 22	Nov. 25	Nov. 22	Nov. 21	Nov. 2
Milwaukee, Wis	Lake Michigan	(²)	(²)	(2)	(*)	(7)
Moorhead, Minn	Red River					
Nashville, Tenn	Cumberland River.	(²)	(*)	(²)	ტ	(f)
Omaha, Nebr	Missouri River		- <u>-</u>		Nov. 22	Nov. 2
Oswego, N. Y	Lake Onterio	Dec. 2	Dec. 6	Dec. 1	Dec. 4	Doc.
Pittaburg, Pa	Monongahela River	(²)	(*)	(°)	(ጎ	(7)
Poplar River, Mont	Missouri River	N 0.	37 33	Nov. 19		·
Port Huron, Mich		Nov. 30	Nov. 23		Dec. 20	Dec. 1 Dec.
Rochester (Charlotte), N. Y	Lake Ontario	(3)	(*)	(3)	Dec. 17	Dec.
Saint Louis, Mo	Mississippi River.	Nov. 29	Nov. 29	Jan. 14, '74	Dec. 20	(4)
Saint Paul, Minn	do	Nov. 20	Nov. 12	Nov. 15	Nov. 16	Nov. 1
Saint Vincent, Minn.	Red River	Nov. 13	Oct. 28	Nov. 7	Oct. 17	Nov.
Sandusky, Ohio	Lake Erie	Dec. 7	Nov. 30	Nov. 29	Dec. 12	Jan. 18,
Sully, Fort, Dak	Missouri River					
Toledo, Ohio	Lake Erie	Dec. 4	Nov. 29	Dec. 5	Dec. 9	Dec. 1
Yankton Dak	Missouri River	. <b></b>	l		Nov. 26	Nov. 2

¹ Data for Pembina, Dak., prior to September, 1880.

# APPENDIX 54.

nal Service, United States Army, for the years specified (1871 to 1885, both inclusive).

				NAVIGATIO	ON CLOSED.				
1876.	1877.	1878.	1879.	1880.	1881.	1882.	1883.	1884.	1885.
Dec. 10 Dec. 9	Dec. 29 Jan. 5, '78	Dec. 21 Dec. 7	Dec. 21 Dec. 12 (²)	Nov. 25 Dec. 12	Jan. 5, '82 Jan. 1, '83 (2)		Dec. 16 Dec. 19 (7) Dec. 22	Dec. 19 Dec. 17 (2)	Dec. 8 Jan. 8, '86 (2)
Nov. 15 Dec. 17	Nov. 29 Dec. 13	Dec. 16 Dec. 7	Nov. 27 Dec. 14 Nov. 8 Dec. 18	Nov. 18 Dec. 8 Nov. 12 Dec. 27	Nov. 17 Dec. 30 Nov. 9	Nov. 11 Dec. 1 Nov. 6 Dec. 9	Nov. 15 Dec. 7 Nov. 8 Dec. 20	Dec. 14 Dec. 6 Nov. 8 Dec. 18	Dec. 6 Dec. 25 Nov. 9 Dec. 7
Dec. 31 (2) Dec. 1 Dec. 18 Dec. 11	(3) (2) Dec. 5 (2) Dec. 12	Dec. 25 ( ² ) ( ³ ) Dec. 25 Dec. 15	(3) (4) Dec. 16 (2) Dec. 24	Dec. 29 (2) Nov. 30 Dec. 29 Dec. 13 Nov. 17	(²) (²) Nov. 17 (²) Dec. 13	(2) (2) Dec. 7 (2) Dec. 11 Nov. 12	(*) (2) Dec. 15 (2) Dec. 20 Dec. 8	(2) (2) (2) Dec. 25 Dec. 15	Dec. 9 (2) Dec. 26 Jan 14,'86 Dec. 28 Dec. 10
Dec. 1 (3) Nov. 26 Dec. 4	Nov. 30 (3) Dec. 23 Dec. 7	Dec. 18 (3) Nov. 12 Nov. 14	Dec. 14 (3) Nov. 23 Nov. 29	Nov. 22 (3) Nov. 16 Nov. 30	Dec. 29 Dec. 7 Nov. 24 Dec. 27	Nov. 22 (3) Nov. 21 Dec. 4	Dec. 2 Dec. 9 Nov. 23 Dec. 4	Dec. 17 Nov. 22 Dec. 10 Nov. 21 Dec. 1	Dec. 5 Dec. 12 Nov. 18 Nov. 29
Dec. 10 Dec. 8 Nov. 23 Nov. 30 Dec. 31	Dec. 15 Jan. 5, 78 Dec. 10 Dec. 2	Dec. 20 Dec. 11	Dec. 15 Jan. 5, '80 Dec. 10 Dec. 12	Nov. 18 Nov. 19	Dec. 15 Jau. 1,'82 Dec. 26 Dec. 31 Dec. 30	Dec. 8 Dec. 10 Dec. 4 Dec. 8 Jan. 9, '83	Dec. 15 Dec. 15 Dec. 11 Dec. 18	Dec. 13 Dec. 18 Dec. 12 Nov. 24	Dec. 10 Dec. 8 Dec. 6 Dec. 7 Jan. 7, '86
Dec. 31 Dec. 9 Nov. 26	Jan. 4, '78 (3) Nov. 28 (2)	Dec. 26 Nov. 26	Dec. 14 (3) Nov. 23 (2)	Dec. 6 Dec. 28 Nov. 29	Nov. 23 (*) Nov. 15	Jan. 14, '83 Nov. 27 (*) Nov. 11	Dec. 31 (7) Dec. 22 Nov. 28 (3) Nov. 17	Dec. 18 (2) Jan. 3, '85 Dec. 5 (2) Nov. 19	Feb. 18 Jan. 6, '86 Dec. 2 (2) Nov. 25
(²) Nov. 24 Dec. 2 (²)	Jan. 1 Jan. 4,'78 Dec. 6 (²)	(²) Dec. 18 Dec. 8 (²)	(²) Dec. 10 Dec. 1 (²)	(*) Dec. 28 Dec. 6 (*)	Jan. 2, '82 Dec. 11 (²)	Dec. 1 Dec. 5 (2)	Dec. 29 Dec. 11 (²)	(²) Dec. 17 Dec. 18 (²)	(*) Dec. 9 Dec. 16 (*)
Dec. 16 Dec. 1	Dec. 9 Dec. 21	Dec. 15 Dec. 1	Dec. 14 Dec. 3	Dec. 10 Dec. 19	Nov. 21 Dec. 5	Dec. 8	(2) Jan. 5, '84 Dec. 12	Dec. 21.	(3) Dec. 16 Dec. 15
Dec. 2 Nov. 19 Oct. 10 Dec. 9	(7) Nov. 27 Dec. 1 Dec. 27	Dec. 17 Dec. 1 Oct. 30 Dec. 24	Dec. 18 Oct. 25 Nov. 2 Dec. 13	Nov. 18 Nov. 16 Nov. 12 Nov. 19	(²) Nov. 18 Nov. 13 Jan. 1,'82	Dec. 7 Oct. 19 Nov. 11 Dec. 8	Dec. 19 Nov. 6 Nov. 11 Dec. 15	Dec. 19 Nov. 12 Nov. 22 Dec. 15	Dec. 10   Jan 9.'86   Nov. 16   Nov. 13   Dec. 7   Dec. 8
Dec. 5 Nov. 15	Dec. 10 Dec. 24	Dec. 18 Dec. 14	Dec. 15 Dec. 3	Dec. 1 Nov. 17	Dec. 27 Nov. 18	Dec. 16 Dec. 2	Dec. 18 Dec. 16	Dec. 16 Dec. 15 Dec. 14	Dec. 7 Dec. 8

² Navigation uninterrupted.

² No reliable record.

APPENDIX 55. Dates of opening of navigation on the lakes and rivers, at selected stations of the

S4-44	Lakes or rivers.		N.	<b>VIGATION</b>	OPENED.		
Stations.	Larges of Hvels.	1871.	1872.	1873.	1874	1875.	1876.
Albany, N. Y. Alpena, Mich Baltimore, Md. Benton, Fort, Mont.	Hudson River Lake Huron Patapsco River . Missouri River	Mar. 13 Mar. 17 (²)	Apr. 8 Apr. 17	Apr. 14 Apr. 30	Mar. 21 Mar. 20 (²)	Apr. 8 Apr. 19 (*)	Apr. 1 Apr. 19
Bismarck, Dak Buffalo, N Y Buford, Fort, Dak	Lake Erie Missouri River	Apr. 3 Apr. 1	Apr. 15 May 5	Mar. 17 Apr. 29	Apr. 13 Apr. 18	Apr. 17 May 12	Mar. 25 May 10
Cairo, Ill	Mississippi River.	( ² )	(3)	(3)	Dec. 31	Feb. 24	(3)
Cairo, Ill	Ohio River Tennessee River Lake Michigan. Ohio River		(3) (2) Apr. 28 Feb. 20 Mar. 10	(3) (2) May 1 Feb. 4 Mar. 11	(²) (²) ▲pr. 29 (²) Mar. 18	Feb. 22 (²) Apr. 28 Feb. 24 Apr. 1	(*) (*) Apr. 28 (*) Apr. 4
Custer, Fort, Mout Davenport, Iowa		Feb. 25	Mar. 23	Mar. 15	Mar. 10	Apr. 2	Mar. 7
Detroit, Mich	River. Detroit River	Mar. 8 Mar. 13	Apr. 4 Apr. 3	Apr. 7 Apr. 1	Mar. 24 Mar. 25	Mar. 29 Apr. 5	Apr. 5 Mar. 14
Duluth, Minn Erie, Pa Escanaba, Mich	Lake Superior Lake Erie Little Bay de	May 4	Мау 14 Арг. 28	May 24 Apr. 17 May 1	May 4 Apr. 4 Apr. 30	May 15 Apr. 15 May 4	May 9 Apr. 12 May 6
Keckuk, Iowa		(3)	Mar. 14	Mar. 10	Mar. 28	Dec. 22	<b>(²)</b>
La Crosse, Wis	Missouri River . Ohio River	Mar. 13 (3) (3) Apr. 2	Apr. 8 Feb. 20 (3) Apr. 28	Mar. 19 (3) (3) May 1	Mar. 28 Feb. 1 (³) Apr. 29	Apr. 7 Mar. 14 Jan. 80 Apr. 28	Apr. 7 Feb. 8 (3) Apr. 28
Marquette, Mich	Lake Superior Lake Michigan.	May 9	May 13 (2)	May 21	May 13 (²)	May 20 (*)	May 12 (*)
Moorhead, Minn		(2)	(')	(²)	(2)	(²)	(4)
Omaha, Nebr	Missouri River . Lake Ontario Mono n g a h e la River.	Apr. 4 (*)	Apr. 13 (²)	Αpr. 7	Apr. 2	Mar. 30 Apr. 29 (*)	Apr. 3 Apr. 6 (*)
Poplar River, Mont Port Huron, Mich Rochester (Charlotte), N. Y. Saint Louis, Mo	Missouri River. Lake Huron Lake Ontario Mississippi River.	Mar. 16 (2) Jan. 13	Apr. 12 (²) Feb. 24	Apr. 14 (2) Feb. 10	Mar. 23 Mar. 23 Jan. 21	Apr. 10 Apr. 19 Mar. 1	Apr. 6 Apr. 8 (2)
Saint Paul, Minn	Red River Lake Erie	Apr. 10 Apr. 16 Apr. 1	Apr. 23 Apr. 20 Apr. 1	Apr. 17 Apr. 25 Mar. 18	Apr. 23 Apr. 19 Mar. 7	Apr. 25 Apr. 21 Apr. 1	Apr. 22 Apr. 22 Mar. 10
Sully, Fort, Dak Toledo, Obio Yankton, Dak	Missouri River . Lake Erie Missouri River .	Mar. 16	Apr. 9	Mar. 28	Mar. 19	Apr. 13 Apr. 3	Apr. 3 Apr. 6

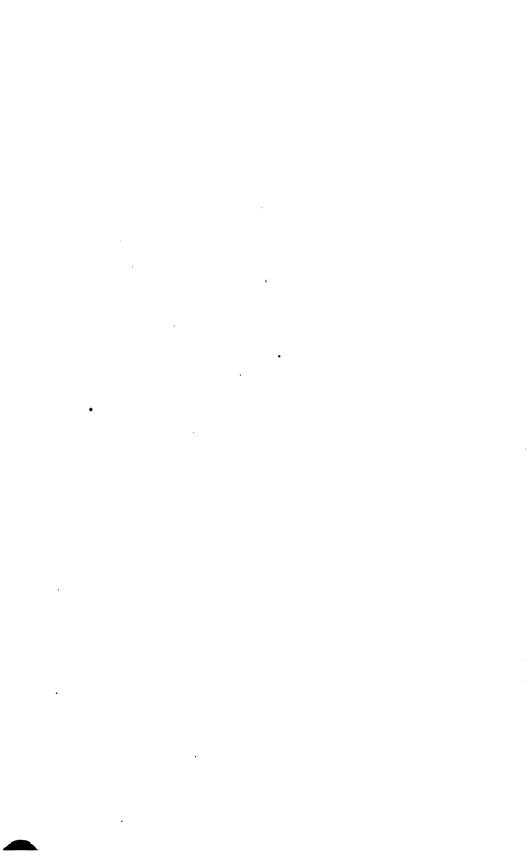
Data for Pembina, Dak., prior to September, 1880.
 Navigation uninterrupted.
 No reliable record.

# APPENDIX 55.

Signal Service, United States Army, for the years specified (1871 to 1885, both inclusive).

			1	MAVIGATIO	M OPENED.				
1877.	1878.	1879.	1880.	1881.	1882.	1883.	1884.	1885.	1886.
Mar. 26 Apr. 21 (²) Mar. 30 Apr. 26	Mar. 7 Mar. 10. (2) Mar. 16 Mar. 16	Mar. 29 Apr. 5 (²) Mar. 29 Apr. 24 Apr. 19	Mar. 1 Mar. 6 (2) Mar. 30 Mar. 19 Apr. 25	Mar. 16 Apr. 29 (*) Mar. 29 May 1 Apr. 16	Mar. 5 Mar. 6 (*) Mar. 15 Apr. 5 Mar. 26 Apr. 17	Mar. 31 Apr. 19 (2) Mar. 15 Apr. 10 Apr. 25 Apr. 13	Mar. 26 Apr. 11 (²) Feb. 24 Mar. 29 Apr. 22 Apr. 20	Apr. 8 Apr. 26 (²) Feb. 28 Apr. 4 May 2 Apr. 28	Mar. 27 Apr. 15 (*) Feb. 11 Apr. 8 Apr. 15 May 5
Feb. 4  Jan. 20 (2) Apr. 20 Jan. 12 Apr. 10  Mar. 30	(3) (2) Mar. 14 (2) Mar. 20 	Jan. 30 Jan. 26 (2) Apr. 23 Jan. 16 Apr. 2 Mar. 16	Jan. 3  (3) (2) Apr. 5  (2) Mar. 9  (3) Mar. 6	Feb. 25 Jan. 19 (2) May 4 Jan. 13 Mar. 24 (3) Apr. 16	(²) (²) (²) Apr. 5 (²) Mar. 14 Mar. 29 Mar. 10	(2) (2) (2) Apr. 28 (7) Apr. 7 Mar. 15 Mar. 27	(2) (2) (3) Apr. 28 (1) Mar. 27 Mar. 19 Mar. 24	(7) (2) May 6 Mar. 6 Apr. 17 Mar. 12 Mar. 31	Feb. 17 Jan. 19 (2) Mar. 20 Feb. 11 Mar. 25 Feb. 28 Mar. 22
Apr. 10 Feb. 25	( ³ ) Mar. 10	( ³ ) Mar. 22	Mar. 9 Mar. 5	( ³ ) Apr. 12	Mar. 13 Mar. 2	Apr. 7 Mar. 29	Mar. 27 Apr. 1	Apr. 5 Apr. 5	Mar. 15 Mar. 27
Apr. 29 Apr. 22 Apr. 21	Apr. 12 Apr. 1 Mar. 16	Apr. 28 Apr. 1 Apr. 25	May 1 Mar. 20 Apr. 12	May 9 Apr. 27 May 3	Apr. 23 Apr. 4 Apr. 7	May 2 Apr. 25 Apr. 24	May 1 Apr. 10 Apr. 15	Apr. 27 Apr. 30 May 5	May 4 Apr. 13 Apr. 24
Mar. 26 Mar. 27 Fob. 9 Jan. 17 Apr. 20	Mar. 8 Feb. 22 Jan. 2 (3) Mar. 14	Mar. 15 Mar. 26 Feb. 10 Jan. 22 Apr. 23	Jan. 8  Mar. 7  Jan. 6  (3)  Apr. 5	Mar. 30 Apr. 9 Mar. 14 Jan. 23 May 4	Jan. 12 Mar. 4 Jan. 21 (2) Apr. 5	Mar. 5 Apr. 6 Feb. 25 (2) Apr. 25	Mar. 24 Mar. 29 Feb. 25 ( ⁷ ) Apr. 24	Mar. 20 Apr. 1 Mar. 10 Mar. 1 May 1	Mar. 16 Mar. 28 Feb. 20 (2) Apr. 21
May 5 (2) Jan. 7	Apr. 18 (²)	May 8 (²)	May 4 (2)	May 11 (2) Apr. 23	Apr. 25 (²) Apr. 14 (²)	May 5 (*) Apr. 16 (2)	Apr. 30 (7) Apr. 19 (7)	May 11 (2) Apr. 24	Apr. 28 (²) Apr. 12 (²)
Mar. 2 Apr. 19	Feb. 19 Mar. 9 (*)	Mar. 9 Apr. 9 (2)	Apr. 5 Mar. 21 (2)	Apr. 13 Apr. 15 (*)	Mar. 10 Mar. 21 (²)	Mar. 9 Apr. 5 (²)	Apr. 5 Apr. 5 (2)	Apr. 14 May 6 (²)	Mar. 17 Apr. 1 (²)`
Apr. 23 Apr. 5 Feb. 6 Apr. 17 Apr. 23	Mar. 24 Apr. 4 (3) Apr. 20 Mar. 18	Apr. 3 Apr. 7 Jan. 31 Apr. 21 Apr. 12 Mar. 24	Mar. 22 Mar. 24 Jan. 1 Apr. 14 Apr. 24 Mar. 8	Apr. 27 Mar. 26 Feb. 15 Apr. 15 Apr. 25 Mar. 19	Apr. 27 Mar. 7 Mar. 30 (7) Apr. 10 Apr. 17 Mar. 1	May 3 Apr. 18 Apr. 9 Jan. 30 Apr. 20 Apr. 21 Mar. 15	Apr. 29 Apr. 8 Apr. 4 Feb. 5 Dec. 29 Apr. 16 Apr. 19 Mar. 18	Apr. 31 Apr. 23 Apr. 24 Dec. 24 Apr. 21 Apr. 21 Apr. 1	May 7 Mar. 28 Apr. 4 Feb. 17 Apr. 17 Apr. 15 Mar. 31
Apr. 2 Apr. 17 Feb. 22	Mar. 6 Mar. 18 Feb. 19	Apr. 7 Mar. 23	Mar. 3 Feb. 24	Apr. 7 Apr. 24	Feb. 25 Mar. 17	Apr. 9 Mar. 13	Mar. 26 Mar. 20 Mar. 22	Mar. 18 Apr. 1 Mar. 14	Mar. 23 Mar. 23 Mar. 18

Data for Pembina, Dak., prior to September, 1880.
 Navigation uninterrupted.
 No reliable record.



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cific Railroads	45	8
cific Kailroads		_
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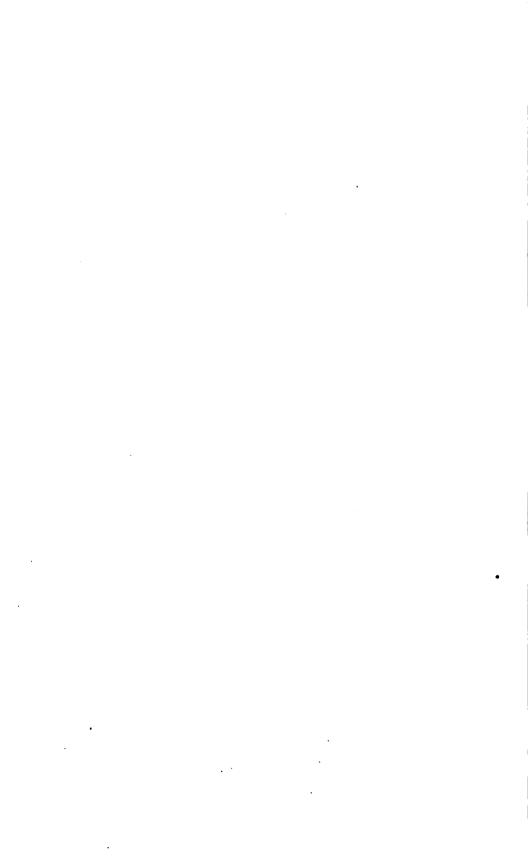
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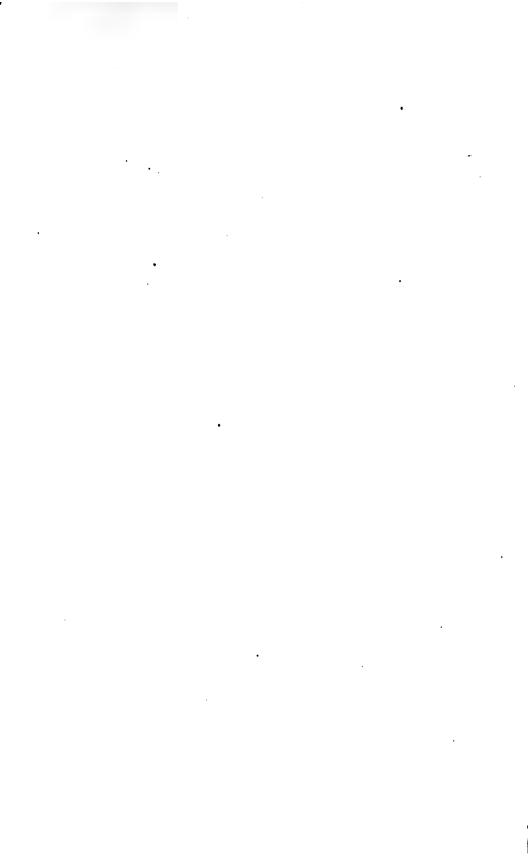
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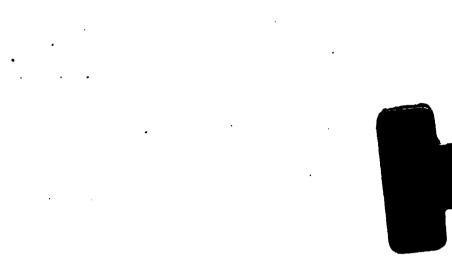
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